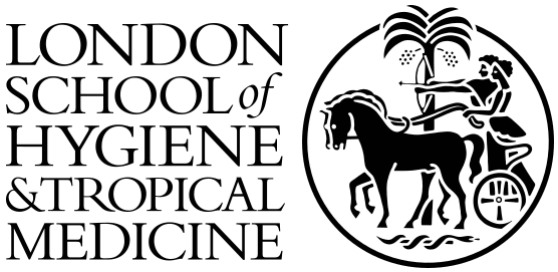

Evaluation of a Complex Health Intervention in Zambia: The case of the Better Health Outcome through Mentorship and Assessment (BHOMA) Applying system wide approaches to measuring health system strengthening: Essential Markers and Impact Pathway

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[To God be the glory, Great things He has done!]

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ABSTRACT:

Introduction:

In many low income countries the delivery of quality health services is hampered by health system-wide barriers which are often interlinked, however empirical evidence on how to assess the level and scope of these barriers is scarce. It has been recognised that taking a more comprehensive approach to assessing these barriers is more likely to provide lessons on what works and why. WHO has been advocating the use of systems wide approaches such as systems thinking to guide intervention design and evaluation. This thesis reports system-wide assessment of a complex health system intervention in Zambia known as Better Health Outcome through Mentorship and Assessment (BHOMA) that aimed to improve service quality at the health facility and influence service demand from the community.

Methodology:

This study is nested within a cluster randomised trial of the BHOMA intervention that aims to strengthen the health system in three rural districts covering 42 health facilities in Zambia. The main trial has a stepped wedge design where the intervention is being rolled-out to all the 42 health facilities over a period of 4 years. A baseline health facility survey was done in 2011. This was followed by a 12 months post-intervention evaluation survey. At the time of the follow up survey 24 health facilities had received the intervention while 18 had not. Data collection used both quantitative and qualitative methods. The study was guided by a systems thinking theoretical framework which was inspired by the WHO building blocks for health system strengthening.

Results:

The baseline survey validated tools and indicators for assessing health system building blocks. Research paper 2 applied an innovative measure of health worker motivation which was initially applied in Kenya. The results showed that this simple tool was reliable with cronbach's alpha of 0.73 for the 21 item measures of

health workers' motivation. Baseline assessment of health worker motivation showed variation in motivation score based on gender and access to training. Research paper 3 tested and applied a new tool for measuring health systems governance at health facility level. The new tool for measuring governance was reliable with the 16 item one side cronbach's alpha ranging between 0.69-0.74.The tool was simple to use and found to be applicable in the Zambian health care setting.

A balanced scorecard approach was applied to measure the baseline health system characteristics for the target districts. Differences in performance were noted by district and residence in most domains with finance and service delivery domains performing poorly in all study districts. Regression modelling showed that children's clinical observation scores were negatively correlated with drug availability (coeff 20.40, p = 0.02) while Adult clinical observation scores were positively association with adult service satisfaction score (coeff 0.82, p = 0.04)

Baseline qualitative results are presented in paper 5. The results showed close linkages between health system building blocks. Challenges noted in service delivery were linked to human resources, medical supplies, information flow, governance and finance building blocks either directly or indirectly.

The 12 months post intervention survey applied both quantitative and qualitative methods. Research paper 6 presents 12 months post intervention quantitative results applying the balanced scorecard approach as at baseline. Comparison was made between the control and intervention health facilities. The results showed significant mean differences between intervention (I) and control (C) sites in the following domains: Training domain (Mean I:C;87.5.vs 61.1, mean difference 23.3,p=0.031),adult clinical observation domain (mean I:C;73.3 vs.58.0, mean difference 10.9,p=0.02).

The 12 months post intervention qualitative evaluation applied systems thinking approach and the conceptual framework developed before the intervention. The findings are presented in research paper 7. The overall results showed that the community had accepted the intervention with increasing demand for services reported in all sites where the BHOMA intervention was implemented. The indications were that in the short term there was increased demand for services but

the health workers' capacity was not severely affected. However, from a systems thinking perspective, it was clear that several unintended consequences also occurred during the implementation of the BHOMA.

Conclusion:

In evaluation of complex interventions such as the BHOMA attention should be paid to context. Using system wide approaches and triangulating data collection methods seems to be important to successful evaluation of such complex intervention.

ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal Care
ART	Anti -Retroviral Therapy
ARVs	Anti-Retroviral Drugs
BCG	Bacillus Calmette-Guérin
BHOMA	Better Health Outcomes through Mentoring and Assessment
BSC	Balanced Scorecard
CCT	Conditional Cash Transfer
CPOE	Computerized Physician order Entry
DFID	Department for International Development (UK)
DPT	Diphtheria, Pertusis and Tetanus Vaccine
EMR	Electronic medical records
FDG	Focus Group Discussion
HFAN	Health Facility Assessment Network
HIS	Health information System
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information System
HMN	Health Matrics Network
HSS	Health System Strengthening
IT	Information Technology
MDGs	Millennium Development Goals
MoH	Ministry of Health
NGOs	Non-Governmental Organisations
PDAs	Personal Digital Assistant (PDA)
PEPFAR	President's Emergency Plan For AIDS Relief

TB	Tuberculosis
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations Children’s Fund
USA	United States of America
WHO	World Health Organisation

DEFINITIONS OF COMMON TERMINOLOGY IN THE THESIS

System- wide approach

This refers to an approach which looks at the broader perspective of the system in contrast to having disease specific focus. The aim is to provide a comprehensive analysis of the various elements that make up the system[1]. Examples of system-wide approaches used in this thesis include systems thinking and balanced scorecard

Systems thinking

This is a systems analysis tool, which is based on systems theory[2,3,4] Systems thinking is a way of helping an individual to view systems from a broad perspective that includes seeing overall structures, patterns and cycles in systems, rather than seeing only specific events in the system [2,5].

Health system

Defined by WHO as, “all the activities whose primary purpose is to promote, restore or maintain health”. The health system discussed in this thesis is the Zambian health system with focus on three BHOMA intervention districts

Health System strengthening

These are approaches or activities which aim to improve the six WHO building blocks and managing their interactions in ways that achieve more equitable and sustained improvements across health services and health outcomes [6].The six building blocks include; service delivery, human resource, health information,finance,medical supply and governance.

Balanced scorecard

This is a strategic management tool that was first suggested by Robert Kaplan and David Norton in 1992 [7].It provides information on areas of strategic importance to guide future planning and also serves as a snapshot of how well an organization or system is performing. It consists of the overall vision and domains which relate to activities of an organisation [1,8].We have used the balanced scorecard to measure the effect of the BHOMA intervention

Validity

In the field of science and biostatistics validity is defined as the extent to which a concept or measurement or conclusion is supported and corresponds or reflects the real word settings. The word "valid" stems from the Latin word validus which means strong. For a research tool validity is the degree to which it measures what it claims to measure [6,7,8].The validity of the research design and experiment is the ability of the research to answer the question it was set to answer. Validity is considered very important in scientific enquiry as it supports the selection of tests and help to ensure that scientists apply research methods that are both ethical and valid for the question to be answered. We applied the term in relation to validation of the tools for measuring health worker motivation and governance.

Reliability

Reliability is often used to describe the overall consistency of a measure. A measure has a high reliability if it reproduces similar results when applied to similar or consistent conditions [6,8].Reliability and validity are not the same. A reliable test measures something and produces consistent results but it could be measuring a wrong thing. We used cronbach’s alpha to determine the reliability of the items used to measure health worker motivation and governance

Generalisability

Generalisability refers to a scientific framework which is used for conceptualising, investigating and designing reliable study observations. It focuses on the reproducibility of the measurements under similar conditions[8].We used this term in reference to the generalisability of the findings in the BHOMA intervention

CHAPTER 1:

1 General Introduction

1.1 Health systems challenges: The Role of Health systems research in low income settings

There has been tremendous amounts of donor funding that have targeted the health sector in low- and middle-income countries [9,10,11]. Despite these investments, the current evidence point to little or no impact [12,13].At the same time, it has been acknowledged that weak health systems are a major barrier to attainment of health goals and that this could explain the lack of impact for investments in health in many low income countries. Hence, health system strengthening has become an important global health agenda[13].

While the need for strengthening health systems has been endorsed by global health leaders and governments, there is currently limited evidence and experience on how to design and evaluate health system strengthening interventions.[14]. Timely and policy relevant research is urgently required especially at a time when many countries are still lagging behind in reaching millennium targets.[14,15]. To catalyse this process, WHO has recently launched the first global strategy on health policy and systems research [14]. The strategy highlights the important role of heath policy and systems research to support efforts aimed at strengthening weak health systems in many low income countries. This will ensure universal and equitable health coverage of health services[14,16].

This thesis is in line with this strategy and supports the call to generate evidence to guide investments aimed at strengthening the health systems in low and mid income countries.

1.2 Scope and composition of the thesis

This thesis had been organised according to Chapters. Chapter 1 starts with the general introduction which gives a general direction and outline of the thesis.

Chapter 2 is literature review. It starts with the current arguments and debate about health systems and highlights the activities of actors in global health systems

and the impact on health system in low income settings. The literature review then extends to the methods and frameworks for measuring health system improvements and their limitation. Starting with historical context and leading to the current framework WHO is advocating for health system strengthening. The later part of the literature review attempts to summarise studies that have demonstrated effect of strengthening specific health system building blocks and limitations. The last part of the literature review looks at the current challenges in providing comprehensive evaluations targeting health system strengthening.

Chapter 3 is the methodology section which consists of the country and study setting and context. A summary of the methodology is given and the rest of the methodology is given in *Research Paper 1*: **Systems thinking in Practice: Proposed approach to evaluation of the six WHO building blocks for health system strengthening. A methodological paper.**

This research paper gives a summary of the BHOMA study methodology and the proposed framework for evaluating the BHOMA intervention applying systems thinking concepts. It provides the theoretical basis for the evaluation, highlighting possible consequences of the intervention. It applies feedback loops to show the interaction and interdependence between health system building blocks, context and the community. This paper has been submitted to Plos One for publication

Chapters 4 to 9 are the main results sections which are made up of published and submitted research papers. The baseline results are presented in chapters 4 to 7 while the 12 months post intervention follow-up results are presented in Chapters 8 and 9. The following section highlights the contents of each results chapter.

- Chapter 4 consists of published *Research Paper 2*: **Measuring health workers' Motivation in rural health facilities: Baseline results from the three study districts in Zambia** Published in the Journal *of human resources (BMC): This paper had two specific objectives:*
    - *To validate the measures of motivation initially applied in Kenya (Mbidyo et al, 2011), in the Zambian context.*

- *To describe baseline motivation scores in the target districts with the aim of repeating the measures in the follow up studies comparing intervention and control sites*

- Chapter 5 consists of published research Paper 3: **Measuring Governance at health facility level**: Published in the Journal of *International Health and Human rights (BMC).This paper had two specific objectives*
    - *To develop a tool for measuring health system governance at health facility level*
    - *To measure baseline governance scores in target districts with the aim of repeating the measures in subsequent studies comparing control and intervention sites*

- Chapter 6 is made of published research Paper 4: **Measuring health system strengthening: Application of the Balanced Scorecard approach to rank the baseline performance of three rural districts in Zambia.** This paper had two specific objectives:
    - *To validate the indicators and domains to be used in the evaluation of the BHOMA intervention*
    - *To apply the concept of balanced scorecard in describing the baseline status of three BHOMA target districts*

- Chapter 7 is comprised of research paper 5; ***Systems thinking in Practice:*** **The current status of the Six WHO building blocks for Health System Strengthening in three BHOMA intervention districts of Zambia:** ***A baseline qualitative study published in the journal of*** *Health Services Research and Policy (BMC).*This *paper had two main objectives*
    - *To provide a baseline qualitative analysis of the status of the health systems building blocks in the target districts*
    - *To triangulate and complement information collected using quantitative Approaches*

- Chapter 8 is made up of research paper 6: **Application of Balanced Scorecard in the evaluation a complex health system intervention: Preliminary findings from the BHOMA intervention: A cluster randomised community trial in Zambia.** This paper presents the 12 months follow-up results of the BHOMA intervention applying the same balanced scorecard methodology used at Baseline. The results compare the control and intervention sites. The objective was to find out whether the intervention had an effect on health system building blocks.

- Chapter 9 is the final results chapter which presents *Research Paper 7*: **Application of systems thinking: 12 months post intervention Evaluation of a complex health system intervention in Zambia: The case of the BHOMA** This paper uses qualitative methods to provide process and context analysis of the BHOMA intervention guided by system thinking approach. It reports the intended and unintended consequences of the BHOMA intervention. The objective was to provide complement findings from the quantitative results hence a comprehensive evaluation of the BHOMA as being advocated for in health system research.

Chapter 10 is the main discussion section summarising the main findings of the thesis, and limitations. Chapter 11 provides concluding remarks and future direction for research and policy. Chapter 12 contains references while Chapter 13 is the appendices chapter of the thesis.

My role on the BHOMA intervention and publications

I am a research fellow on the evaluation team for the BHOMA intervention. My main focus has been to lead the evaluation team on health system strengthening. I have therefore been in-charge of health facility surveys and providing a link between the implementation, the ministry of health and the evaluation teams.

I designed the framework for measuring health system strengthening and developed the research tools required for evaluating the health system in the BHOMA intervention. I pre-tested the tools and trained all research assistants in the administration of the research tools for health facility surveys.

I supervised data collection at baseline and follow up surveys and supervised data entry. 20 research assistants helped with collection of quantitative data. I cleaned all the quantitative data and analysed all the data at baseline and at the 12 months follow-up. Dr. James Lewis was involved with reviewing the analysis for research paper 6 and helped with statistical analysis for this paper.

I developed all the qualitative data collection tools with support from Dr. Virginia Bond. I personally conducted interviews for all qualitative data with help from two research assistants. Qualitative data was transcribed by two research assistants and I validated all the transcripts. I developed the coding frame and coded all the qualitative data using Nvivo software.

I drafted all the manuscripts included in this thesis and was the first and corresponding author for all the 7 research papers. The co-authors reviewed the manuscripts and provided technical input according to their expertise. Dr. Helen Ayles is the Co-Principal Investigator for the BHOMA intervention and my main supervisor. She reviewed all manuscripts and provided technical support during the designing of the evaluation tools and data collection. Prof. Peter Godfrey-Fausset was involved in the design of the evaluation tools and reviewed research paper 3. Dina Balabanova and Neil Spicer provided policy and health system guidance on the paper drafts.

Margaret Tembo Mwanamwenge is the programme manager for the BHOMA evaluation team and provided technical support for data collection and reviewed all manuscripts.

Other co-authors from the implementation team included; Dr.Jeffrey Stringer who is the Principal Investigator for the BHOMA intervention, Dr. Chintu, Dr. Roma Chilengi who are the Co-Principal Investigators and Ms. Angela Taylor who is the programme manager. Their contribution is specified in respective papers which they co-authored.

CHAPTER 2:

2 BACKGROUND – HEALTH SYSTEMS: CONTEXT, DEBATE, DEFINITIONS

2.1 Context and Current Debates on Health systems

This section provides an overview of the current research and thinking on health systems. It highlights the different approaches to strengthening health systems by global health actors in low income countries and their limitations. The lack of consensus on definition of health systems and health system strengthening and the implication to both research and policy is covered. Most literature is from WHO documents and researchers in the field of health systems.

In the year 2000, the United Nations Millennium Declaration was signed by 189 member countries [17]. These were later translated into eight Millennium Development Goals (MDGs) which were to form a basis for development and poverty eradication throughout the world. Out of the eight MDGs goals, three are directly focused towards improvement of health. These are goals number 4,5 and 6,which refer to reducing child mortality, improving maternal health; and combating HIV/AIDS, malaria, and other diseases respectively[18,19,20]

The drive to produce results for the MDGs has led many stakeholders to focus on disease specific programs which aim to produce quick results [15]. For example, the Global Fund to Fight AIDS, TB and Malaria, Stop TB, Roll Back Malaria, The Presidential Emergency Plan for AIDS Relief(PEPFAR) and the Global Alliance for Vaccines and Immunization(GAVI) have disease specific programs [21]. In many respects, some of the initiatives have led to massive improvements in target countries [22,23]. For example the number of people on antiretroviral drugs (ARVs) has more than tripled in Sub-Saharan Africa and there is evidence which show that life expectancy has improved and mortality has reduced in PERFAR target countries[24].

Nonetheless, it has now been recognised that a primary bottleneck to achieving the MDGs in low-income countries is health systems that are too fragile and fragmented to deliver the volume and quality of services to those in need[15]. In

his description of this problem Chen et al, 2004, mention the “double crisis” of devastating disease and overwhelmingly failing health systems in many low-income countries[25]. The high level forum on achieving the Health Millennium Development Goals identified major shortfalls in the health workforce, lack of donor coordination, and weak information systems as critical challenges to achieving the Millennium Health Goal [26,27]. Furthermore, there is concern that already weak systems may be further compromised by over-concentrating resources in specific programs, leaving many other areas further under-resourced [12,15,22,26,27]

Strong and effective health systems are increasingly considered a prerequisite to reducing the disease burden and to achieving the health MDGs, rather than the outcome of increased investments in disease control[28]. As a consequence, health systems strengthening (HSS) has risen to the top of the health development agenda [28,29].

There is considerable disagreement about which funding approach is best for strengthening health systems in low income countries. One extreme of the debate is that the new global initiatives are destroying health systems in lower and middle income countries and that HIV, malaria and TB have received too many resources at the expense of other diseases affecting local people [30]. It has been claimed that a new inequity could be created in which a disproportionate amount of resources would be allocated to HIV-infected patients while other patients (e.g. those with another chronic or infectious disease, malnourished children, women with obstetric problems) would continue to suffer from inadequate care[30,31,32].

The other argument is that a lot has been achieved in such a short time with the number of people accessing lifesaving antiretroviral drugs going beyond what was initially thought or imagined[24]. In fact is has been argued that these initiatives were as a result of calls to respond to HIV, malaria and TB. Therefore, these could be viewed as new resources that could not naturally come without the advocates for these funds. Hence, the health systems stand to benefit rather than be affected negatively [23,24].In recent times, consensus voices with a more moderate view are now dominating this debate emphasizing that health systems need both vertical and horizontal programs, working in harmony, to deliver effective, equitable, and affordable health services[23,24,33]. Commenting on these divisions in the research

community Buve and El-Sadr have warned that the debate on the use of the funds for HIV/AIDS, malaria and tuberculosis should not deteriorate to a scramble for funds between advocates of disease control programs and proponents of stronger health systems [30,32].

It has been generally agreed that disease specific programs require a well-functioning health system and that well-functioning health systems need both governmental and donor support. So the two are not mutually exclusive but have the potential for synergy.[29,33]. [30,32].

2.2 What is a Health System?

The definition of a health system is yet to be agreed by stakeholders. It appears that there is no common and consistent answer to the question “what is a health system?” In many cases, the term ‘health system’ has been used to suit particular interests and agendas. This ambiguity in the concepts and meanings of a health system have been a source of much confusion in public health debate and policy deliberations [34]. It must be noted that Policy makers have a specific interest in the development of an adequate and consistent definition for the purpose of learning which instruments or interventions will help in improving the performance of their health systems. Researchers equally would like to use consistent definitions so that they can compare interventions and could speak the same language [34,35].

In 2000, WHO defined health systems as “all the activities whose primary purpose is to promote, restore or maintain health”. This definition includes the full range of players engaged in the provision and financing of health services both the public and private. Health systems encompass all levels: central, regional, district, community, and household. According to the WHO, health care systems' have multiple goals which include improving health for the citizens, responsiveness to the expectations of the population, and fair means of funding operations. However, this definition has been criticised as being too vague and failing to account for other sectors that contribute to health but not directly, for example the education sector may contribute to improvement in general public health but this is not captured in the definition. [36].

It has been suggested that one reason technical support for health systems strengthening is lagging behind is due to the difficulties in articulating clearly what a health system is, its role and how it can be strengthened [21]. In many cases analogies have been used in an effort to provide a clearer picture of health systems. Some have likened the health system to a computer that consists of hardware and software. In health systems, the hardware refers to infrastructure, people, and pharmaceuticals supplies and while the software is equivalent to financing, policies and management structures. Others have defined a health care system as a set of connected or interdependent parts or agents including caregivers and patients who are bound by a common purpose and acting on their knowledge [37]. Unfortunately it remains the case that different people and organisations define health systems differently[38].

2.3 What is Health System Strengthening (HSS)?

Like the definition of health systems, little consensus exists about the definition of HSS. A recent literature review identified 39 separate categories related to the definition of HSS[39]. This has meant that stakeholders have used this term to justify their activities when in fact they are promoting their organizational interests [21,39]. Many global initiatives have acknowledged this danger and efforts have been made to align activities around the proposed framework by WHO in health systems strengthening [38].

WHO has defined health system strengthening as improving the six WHO building blocks and managing their interactions in ways that achieve more equitable and sustained improvements across health services and health outcomes [40]. The Health systems Action Network (2006) defined health system strengthening (HSS) as any array of initiatives and strategies that improves one or more of the functions of the health system and that leads to better health through improvements in access, coverage, quality, or efficiency [41].For the purpose of this thesis, the WHO definition for HSS will be adopted.

Figure 1: ***WHO building blocks for health system strengthening***

Source:http://www.who.int/healthsystems/strategy/everybodys_business.pdf

2.1 Zambia and the current Health systems

This section provides information on Zambia including location, economic and social context. It covers the current health systems in Zambia at National and sub national Level and how this has been changing over time. More details about the three intervention districts for this study are given in the last few paragraphs. Most literature in this section is provided by Central Statistical Office and the Ministry of Health.

2.2 Country Overview

Zambia is a land locked Country which is found in central Africa. It has a total population of about 13 million. The estimated population of growth rate is 3.1%. The Gross domestic products per capita are $19219. Life expectancy had dropped significantly to about 42 years due to the HIV pandemic but now has gone up 49.2 years in 2010.The under five mortality rate is 81/1000 while infant mortality stands at 53/1000[42,43]. Currently, the major health problems include HIV/AIDS, Tuberculosis, diarrhoea and malaria [44].

The main economic activities include mining, agriculture and tourism. It is estimated that about 85% of Zambians work as subsistence farmers. Commercial agriculture is mostly confined to a small number of large farms along the line of rail. The main crops grown include corn, sorghum, rice, peanuts, sunflower seeds, tobacco, sugarcane, and cotton. In southern, western and eastern provinces of the country, livestock farming is practiced alongside crop production. Copper mining and refining constitutes the largest industry in the country and is mainly concentrated in the towns of the Copperbelt and North-Western Provinces. Other industries mainly based in the capital Lusaka, include food products, beverages, textiles, construction materials, chemicals, and fertilizer. Hydroelectric power is the main source of energy in Zambia. The major foreign exchange earner is copper export. It accounts for over 80% of foreign exchange while other non-tradition exports account for 25 % [42,45,46].

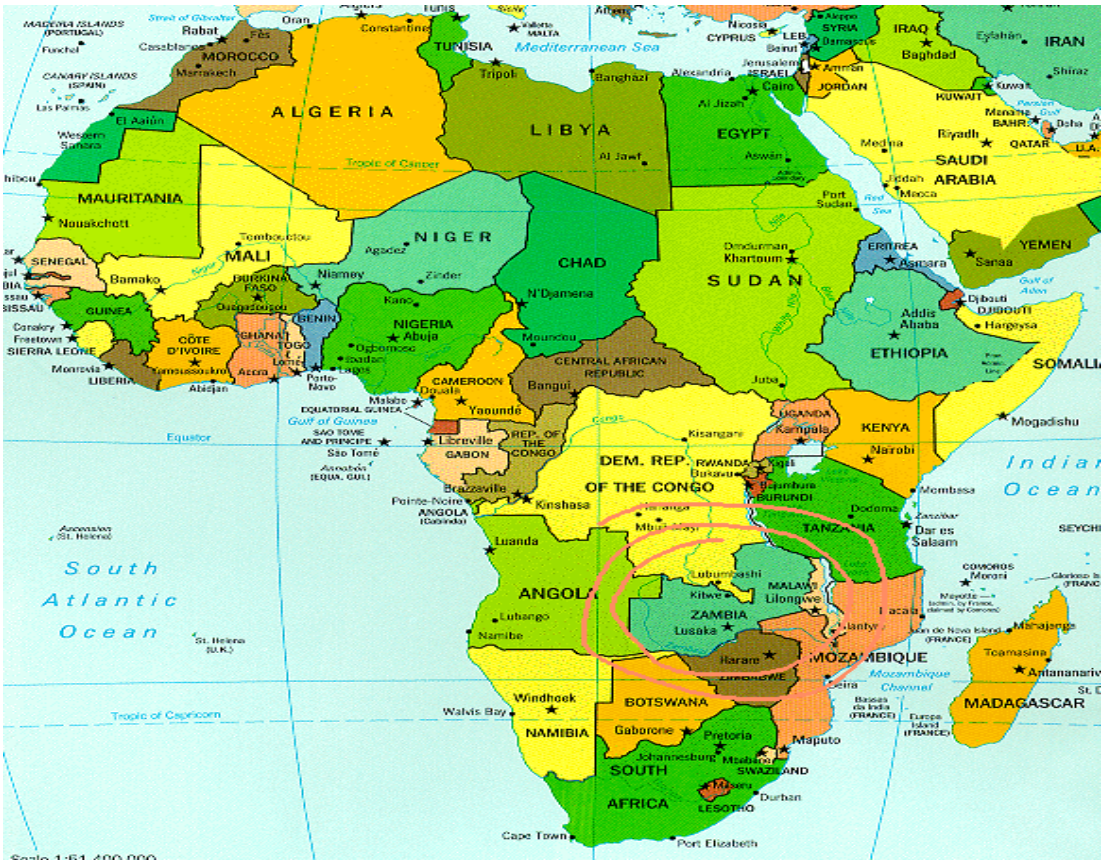

Figure 2: Map of Africa showing the location of Zambia

2.3 Health system Overview

The Zambian health sector has undergone various reforms since independence in 1964. The major reforms began in 1991 when the government embarked on health sector reforms leading to the formation of a separate national body for policy making and program implementation. This was done as part of the decentralisation of health service delivery. In 2004 a new cycle of reforms began where the earlier reforms were reversed with the dissolution of the implementation body, the Central Board of Health, and re-integrated it with the Ministry of Health (MoH). District and Hospital Health Management Boards, which had been established to increase local participation in the decision-making process, were also dissolved. Through the new structure, the MoH aims to increase its oversight of district-level activities through a strengthened provincial level [47,48,49].

The argument for the 2004 health sector reforms was to avoid duplication of responsibilities at the national, provincial, and district levels. In the current scenario, the national level,(MoH) is responsible for making policy, setting and monitoring performance standards, and mobilizing financial resources. The Provincial Health Offices link national and district levels and provide coordination, technical support, and quality assurance. District Health Offices supervise first-level hospitals and health care centres, develop action plans, provide progress reports, manage district budgets, disseminate guidelines, conduct needs and performance assessments, and are responsible for human resource planning and management. Districts are responsible for developing their own three-year plans that reflect local priorities, while working within the five-year National Health Strategic Plan framework.

Within the Zambian government system, there are 10 Provincial Health Offices, 110 District Health Offices, 98 hospitals, 265 urban health centers, 1,029 rural health centers, and 171 health posts. However, the number of districts and health facilities is likely to increase further as the new government has embarked on infrastructure development and expanding access to health care. Health centers are intended to serve 30,000 to 50,000 people in urban areas and 10,000 people in rural areas, with a 29 kilometer radius catchment area. The MoH aims to expand the number of health posts to bring services within 5 kilometers of sparsely populated areas or to serve populations of 500 households in rural areas[50].

The performance of any intervention programme aimed at strengthening health systems in Zambia will inevitably be influenced by this historical context of the health system in line with the research on path dependence that is known to exist in health systems [51].

2.4 Literature review:

This section provides an overview of approaches to evaluation of health systems. The main focus is the evolution of frameworks for measuring performance of the health system and how the current WHO six building blocks framework has been influenced by earlier frameworks.

2.4.1 Measurement of health system performance: Past and present evaluation frameworks

For a long time now, health system researchers have been looking for ways to monitor the performance of health systems. Various attempts have been made to come up with common frameworks to guide health system evaluation[52]. At different times, proposals have been brought forward and often acted as the basis for the next generation of frameworks. It must be emphasized that most of the frameworks describe the normative approaches and have little to do with what actually happens on the ground. Nonetheless, they provide a strong theoretical basis for conceptualising health systems and a start point [52,53].

In the early 1980s, Evans identified four main sets of actors within the health care systems. He called them the served population, the health care providers, third-party payers; and government which was said to be the main regulator[54]. A decade later Hurst and colleagues build on the work by Evans and argued that evaluations should focus on fund flows and payment methods between population groups and institutions. They went on to describe seven major subsystems of financing and delivery of health care, which included three voluntary insurance systems (private reimbursement, contract and integrated models), three compulsory insurance- or tax-funded models (public re-imbursement model, contract and integrated models) and the direct, voluntary out-of-pocket payment model[55].

Other health system researchers have focused on economic relationship between demand, supply and intermediary agencies which influence the supply–demand relationship. The individual or populations are said to demand services which the supplier of the services in both public and private respond to. The governments play a regulatory and resource mobilisation role. [54,55,56,57,58]

A number of scholars have focused on analysis of health system reforms. In many ways, this was in response to the pressure from the international Monetary Fund (IMF) and the World Bank. In the early 80s and 90s, the World Bank and other donors were demanding health reforms as a condition for receiving donor aid. Many scholars endeavoured to provide insights on the best ways to reform and evaluate the health systems in both low and middle income countries. Kutzin and McPake

proposed a 3-step approach to evaluating health reforms broadly. These included the key contextual factors driving reform, the reform itself and its objectives and finally the process by which the reform was being implemented[59].These factors were seen as crucial to the success of health reforms especially in low income countries.

In 1994, Frenk proposed that health reforms have dimensions which are interrelated. He suggested five major groups of actors in the health reform as “the health care providers, the population, the State as a collective mediator, the organizations that generate resources and the other sectors that produce services that have health effects”. In addition, he came up with four policy levels at which health systems reform operates: “systemic, programmatic, organizational and institutional”.

In 1995 Kutzin proposed a framework that allowed for the exploration of health reforms through a financial lens[60].

More recently, Mills and others have conceptualized health systems as comprising of four key functions and consisting of four key actors[61]. They proposed a framework or what they termed “Map” to show the interplay between the four key functions that they identified (regulation, financing, resource allocation, service provision) and the major stakeholders involved in each: Government or professional bodies responsible for regulation; the population, financing agents responsible for collecting and allocating funds; and service providers[61,62].

In 2003, Roberts and Hsiao conceptualized a health system in terms of relationships where the structural components referred to as means interact in such way as to lead to the intended goals of the system. This they called desired “end” [63] . In their framework they identified basically five major “control knobs” of a health system which are available for policymakers to achieve health system goals.

These included financing, macro-organization, payment, regulation and education/persuasion. They argued that to have an effective health system governments and other stakeholders must focus on the overall goal of the health system and use the knobs to control what is happening in the health system[34,63].

It is clear that this framework formed the basis for the World Bank Institutes Flagship Program on Health sector reform and sustainable Financing, which has been renamed “Health System Strengthening” [56].

In coming up with the current framework, WHO has built on the work of earlier frameworks. In its report (2000), WHO proposed four key functions of a health system. These were seen as the main drivers in explaining how health system inputs are transformed into health system outcomes. These key functions are: Resource generation, financing, service provision and stewardship. These functions are said to be pivotal in the function of the health systems [56,64]. In 2007, WHO launched a report entitled “Everybody’s Business: Strengthening Health Systems to Improve Health Outcomes”. In this report, WHO proposed the use of six building blocks in monitoring health system performance. These were; service delivery, health workforce, information, medical products and technologies, financing, and leadership and governance [65]. The WHO argued that the building block approach helps to identify bottlenecks in health system and could guide efforts in resource allocation and performance evaluation [56].

It must be acknowledged that although the system of building blocks is widely accepted, it has also received several criticisms. One such criticism is that while the approach cuts across the vertical disease programs it has the potential to cause fragmentation in the health system focusing on function rather than by disease[53]. The building blocks are also said to ignore the importance of context and the connectedness across the health system building blocks[53]. This later criticism was addressed in the report by WHO highlighting the central role of systems thinking in evaluation of the health system building blocks[66].

Swanson and others have extended this work by proposing ten principles to enhance robust evaluation of health system strengthening. These are holism, context, social mobilization, collaboration, capacity enhancement, efficiency, evidence-informed action, equity, financial protection and satisfaction. In their article they argue that following these ten principles will standardize evaluation of complex health interventions targeting health system[39].

Recently, there have been calls to distinguish between health system strengthening and activities supporting the health system. In their recent work Chee et al,2013 have argued for this differentiation proposing the use of a cube which has facets distinguishing systems strengthening from systems support. They basically extend the same building blocks but look at the activities which are long term and working across the building blocks as strengthening while those short term activities and usually limited to single building as supporting the health system[53].

It must be clear from the above review that the measuring and evaluation mechanisms for complex health systems are still evolving. In fact even the work by WHO on building blocks requires evidence about context specific and general indicators for all health system building blocks. [67,68,69].

2.4.2 Health system strengthening and health outcomes: Individual building block impact on service delivery

2.4.2.1 Human Resources and Service delivery

The role of human resources in health system strengthening has been advocated for many years. Many scholars have been trying to demonstrate the pivotal role that the health workforce has in mitigating the current challenges in health systems. Unfortunately there is lack of trials to demonstrate directly how human resource improvements in health could result in better performance in service delivery and to influence health outcomes. A paper by the joint learning initiative –a consortium of 100 health leaders noted that health workforce is neglected yet it is critical in combating health crises in poorer countries and that it was essential in building sustainable health systems, they further argued that it was impossible to have a vibrant or strengthened health system without health workers who are the ultimate resource of the health system [25]..

In their work Anand S et al, 2004, tried to demonstrate how health human resources can influence service delivery and health outcomes at cross-country level. Their study was conducted using WHO data for health human resources based on 2004 estimates. They performed a cross-country multiple regression analyses with maternal mortality rate, infant mortality rate, and under-five mortality rate as dependent variables. They also used aggregated density of human resources for

health as an independent variable in one set of regressions and then doctor and nurse densities separately. They controlled for possible confounders such as income, female adult literacy, and absolute income poverty. They found that, Doctors, nurses, and midwives together significantly lower these three mortality rates after controlling for other variables used to account for these health outcomes [70].Disaggregated analysis held true for doctors relationship with health outcomes but was less clear for nurses. They cited difficulties in nurse categories as possible reasons why nurse's density seemed not to influence health outcomes independently. Income and maternal literacy were also found to correlate well with the outcomes of interest [70].They concluded that the performance of human resources in attaining health-system goals will be dependent on their distribution across occupations and geographical regions, and other factors such as incentive and decision-making structures[70]

The work by Chen et al showed that on the log scale, worker density was inversely related to maternal, under five and infant mortality. They demonstrated that the target of 80% coverage of immunisation and skilled attendance could be reached if countries had a minimum 2.5 workers per 1000 population based on UN human resources estimates [25,70].

Speybroeck et al, 2006, followed similar methodology to Anand et al, but improved on the data sources and included poor countries which were not included in earlier studies due to lack of data. They collected additional data including censuses and labour force surveys. In agreement with Anand , they found that aggregated health worker densities (doctors, nurses and midwives) were significantly related with measles immunisation coverage. However, disaggregated analysis showed no relationship between nurse density and measles coverage. Doctor density and female illiteracy was well related to measles coverage. They also demonstrated that aggregated health worker density was related to health outcomes such as maternal, infant and under five mortality. Their results differed on nurse density which was not significantly related to infant mortality and under five mortality rates as was shown by Anand et al [70,71].They concluded that further research is required to identify additional explanatory variable such as financing and other resources [71].

Kruk et al, 2009 conducted a similar study to confirm whether doctor and nurse density are associated with coverage of essential health services in mid and low income countries. They found that higher doctor concentration was associated with greater use of measles immunisation and higher nurse concentration was associated with greater use of skilled birth attendants. However they found no association between antenatal care, caesarean section, TB case diagnosis and Care for respiratory infection with health worker density [72].

Farahani et al, 2009 used modelling arguing that the use of a cross-sectional study design in earlier studies could limit the capture of long term benefit of investments in human resources for health. They used data from World Bank especially world development reports and modelled the impact of doctor density on infant mortality between 1960 and 2000. Their results were consistent with those by Anand and Kruk et al, 2009. They found that based on longitudinal data, there was a strong inverse association between physician density and the log of IMR, and were consistent with a 21% reduction in IMR for every physician added per 1000 population. When they included country fixed effects, the strength of the association between health human resources and infant mortality was even bigger translating into a 30% reduction in infant mortality per additional physician for every 1000 population [73]. They concluded that the increase in physician density was an important determinant of infant mortality, particularly in the long run. However, they raised concerns that the relationship across countries between physician density and infant mortality may not be causal but may be due to a hidden factor that affects both, a form of omitted variable bias [73].

Similar findings have been reported by El-Jardali et al, 2007, when they analysed the relationship between physician and nurse density in the Eastern Mediterranean region. Their study revealed that physician and nurse density, and female literacy were significantly correlated with lower mortality rates and higher life expectancy. However, poverty, income and health expenditure were not [74]. A study done in 1968 and republished in 1994 by Cochrane and others found that physician density was not associated with reduction in mortality in the younger age group.

They concluded that there could be other hidden variables that could explain this negative relationship[75].Similarly a study done in 1992 by Kim K et al, using

world bank data for 1998 world reports found that physician density and bed capacity were not correlated with infant mortality. They however found that social economic determinants had a better predictor of infant mortality than physician density. They concluded that the quantity and availability of health care do not have a simple cause-and-effect relationship with mortality levels because of other confounding variables for example accessibility and nation's health program [76]

2.4.3 Finance and Service delivery

Health system financing has been cited as a fundamental building block in health system strengthening. It plays an important role in the performance of health system ensuring equity, efficiency and improved health outcomes [77]. Health financing could be categorised into three basic functions. These are revenue collection, pooling and purchasing. Revenue collection refers to how a health system raises the required funds from various sources including households, businesses and external sources. While risk pooling is the process of accumulation and management of revenues on behalf of pool members so that the benefits and risks are evenly distributed and hence protecting individual pool members from catastrophic health expenditures. Purchasing includes all activities that are undertaken to purchase services from public and private providers or markets [77].

Evidence on the impact of different forms of health financing on health outcomes has been conflicting with some studies clearly demonstrating improved outcomes while others have shown little or no effect [78].The problem is compounded by the fact that most studies done in this area are descriptive with case reports and policy reviews being more prevalent. Rigorous study designs such as randomised trials have been few making it difficult to accept the robustness of the evidence [78].

User fees were introduced in the late 1980s and early 1990s by the World Bank to encourage cost sharing for health services [50]. Studies were done to evaluate the effect of the introduction of user fees on health outcomes including access and health status[78,79]. Almost all studies reported a reduction in uptake of health services following the introduction of user fees. Few studies indicated the opposite effect with an increase in utilisation following introduction of user fees

A study done in Kenya to establish the effect of user fee introduction on service utilisation in a rural district in 1989 compared the uptake of health services during the nine months when all user charges were in force and for two months after the user fees were lifted. They sampled about 200 household using a multistage sampling. They found that attendance at government fee-charging health facilities for both outpatient and inpatient care was lower during the period when user fees were charged compared to the time when fees were removed. For example, outpatient attendance at the hospital dropped by 42% at the health centre following the introduction of user fees. The household survey correlated with findings from the health facility survey where they noted a 52% increase in the utilisation of health services following the removal of user fees. The study also reported increased use of private providers during the time when user fees were in place. This was reversed upon removal of user fees [80].

Another study conducted in urban Kenya looked at the effect of user fees on utilisation of sexually transmitted infections services in the public sector,. The study was designed as a before and after study. They reported a dramatic decrease in demand for the period when the user fees were in place. For men the demand dropped by 40% and for women by 65% following the introduction of user fees [81].

In Uganda a study was done to find out the impact of removal of user fees which were introduced in 1993 and abolished in 2001.The study looked at the attendance in health facilities where user fees were introduced and later removed. Attendance was available for the eight months before and 12 months after cost sharing ceased. They found that after cost sharing was abolished, the mean number of monthly new visits at the 78 facilities for all people increased by 17 928 (53.3%) and 73% of health workers interviewed said that access to health services by the poor had improved following the removal of user fees [82].

In Zambia, a study done by Blas et al, aimed at finding the national impact of user fee introduction. They collected data between 1993 and 1997 from 27 districts including both hospital and health facility covering a total catchment population of 2.5 million people in a country with a total population of about 10 million at the time of the study. They looked at outpatient attendance, admissions and vaccination coverage. They reported that both outpatient attendance and admission dropped

during the time when user fees were in place. Outpatient attendance dropped by 35% [50].

In contrast, a study done in Cambodia showed that user fees led to increased utilisation of health services. A pre and post user fee study was done in a public health hospital delivering maternal and Child health. Data was collected for the period between 1997 and 2000. User fees were introduced in 1997 in the hospital by the ministry of health as part of the health reforms. Interviews were held with health managers and users to elicit their perception on the introduction of user fees. Results showed that the total volume of outpatient services increased twofold within two and half years after user fees were introduced. The total number of preventive services such as ANC visits and infant follow-ups also increased. For inpatient services, the average number of deliveries per month increased after the introduction of user fees by 66% ($p<0005$).The bed occupancy rate also increased by 11% (59% to 70%).The researchers concluded that prior to the adoption of a user-fee scheme, health personnel collected payments from patients privately these funds were never available for investing in the health systems. However, upon official introduction of user fees, illegal collection of funds ceased and all user fees were being channelled towards service delivery and this resulted in better services and increased demand [79].

A literature review of the current evidence for and against user fees was done by Lagarde M et al, 2008.They reanalysed some of the earlier studies and categorising them into those that looked at impact of introductions of users and those that looked at the removal of user fees. They also looked at the effect of increasing or reducing user fees. They included 16 studies in their review. Their findings generally showed that introduction of user fees led to low demand for health services and equally removal of the user fees resulted in dramatic increase in the demand of health services in many low income countries at least in the short term. They noted that most of the studies included had high potential for confounding and that randomised trials were very few. They concluded that more rigorous research in this area is required [83].

Conditional cash transfers (CCT) have also been used to promote access to health by the poor especially in Latin America. The results have shown both positive

and negative effect of this financing mechanism. One well known study was done in Mexico between 1997 and 2003.The study employed a community step wedged randomised trial where communities were randomly allocated to cash transfer intervention or a control group. The intervention in the CCT program was that families receive a cash payment only if they comply with a set of certain requirements. The household were required to attend health facility checks up for children and all lactating mothers and children to receive food supplements. Families who complied with the conditions were eligible for a monthly stipend according to the poverty classification. The study was designed to detect a 10% reduction in the outcomes of interest including height, school enrolment, and change in socioeconomic status measured by per-head consumption. A total of 506 communities were randomised to early (320) and late (186) interventions groups. In 2003 a survey was done to determine the effect of the intervention. Children born during the interventions were assessed for height and weight and Z-scores based on WHO criteria. They reported primary results as effect size for each outcome associated with a doubling of cash transfers from the median of US$806 to $1612, which represented a move from about the 50th to the 75th percentile of total cumulative transfers. The results showed that doubling of cash transfers was significantly associated with an increase in height-for-age Z score and a lower prevalence of stunting ($p<0{\cdot}0001$). In addition doubling of transfers was associated with a lower prevalence of being overweight ($p=0{\cdot}001$), Other observed effect were that doubling of cash transfers was associated with improvements in endurance, long-term memory short-term memory, visual integration and language development for children [84].

A similar study was done in Honduras where 70 municipal communities were randomised to the following interventions: Money to households, resources to local health teams combined with a community-based nutrition intervention; both packages combined or no intervention group. The study was done over a period of two years. The outcomes of interest were the rates of service utilisation by children and pregnant women and the secondary outcomes were vaccination coverage and growth monitoring for children under five years. The hypothesis was that cash transfer to households will improve service coverage in the targeted households. The results showed that the household-level package had a marked impact on the uptake

of antenatal care and routine well-child check-ups by about 20% in household who received vouchers. There was no increase in use of services associated with the service-level package alone.There was no significant increase in the coverage of growth monitoring in municipalities with only the community based nutrition program. The household-level package also increased the coverage of first dose DTP/pentavalent vaccine administered at the appropriate age, but did not affect the coverage of immunisation against measles, or mothers' protection against tetanus [85].

In Nicaragua, Barham T et al, 2009, conducted a study to evaluate the impact of Conditional cash transfers on vaccination coverage in rural communities. They randomly allocated three communities to the intervention and three communities to the control arm. The intervention included a cash stipend made bimonthly to beneficiary households who met the conditionalities during the prior 2 months. They compared vaccination rates for BCG, MCV, OPV3, DPT3, and full vaccination with all four vaccines (FVC) between the control and intervention group. The study was done between 2000 and 2002. The results indicated that vaccination coverage rose dramatically in the treatment group, from 68–77% in 2000 to 87–97% in 2002. Over the same period, however, there was also a substantial rise in vaccination rates in the control group which they attributed to contamination or spill-over effect of the programme to the control group. Both primary and administrative data demonstrated improved vaccination coverage even after controlling for potential confounders [86].

A review article by Palmer et al,2004 of the current evidence on the effect of conditional cash transfer concluded that data is limited to Latin America and that generally there was increased demand for services where conditional cash transfers have been used. Negative effects have also been reported in some studies [78,85]. In Mexico the condition cash transfer was associated with increased rate of Caesarean sections in families which were the beneficiaries of the scheme, highlighting the danger of focusing on a single outcome in evaluating such interventions [87].

Other financing mechanism that have been tried include contracting of health services to private companies, use of community-Based insurance schemes and National health insurance schemes. The results of evaluations of these health

financing schemes have produced mixed effects The design of evaluations have been weak and the complexity of the health systems make it difficult to perform randomised trials [78,88,89].

2.4.4 Governance and Service delivery

In its health system building blocks, WHO has emphasised governance or stewardship as crucial in health system strengthening. WHO acknowledges that governance is a complex building block which involves overseeing and guiding both private and public health systems with aim of protecting public interest. Governance involves both political and technical action in reconciling several competing demands for limited resources. Increasingly donors are demanding for transparency and accountability for their funds and hence the role of health system governance has become even more important [90].

Tracking the improvements in governance inevitably entails looking at other building blocks of the health system such as finance and health information [90].Studies linking governance to health service delivery or health outcomes are generally lacking with exception of some few programmatic data that have looked at governance in relation to health outcomes.

Good governance should, in theory, lead to better performance. More accountability to beneficiaries can be an incentive for health officials and providers to improve services. Thus to achieve a system of good health governance, a number of areas need to be addressed. These include improving the policy process through

ensuring policy- making based on evidence and open, informed, fair and equitable involvement of key stakeholders. Community participation has to be enhanced through increasing local information and leadership, and institutional incentives and openness of officials. Corruption has to be reduced, through tracking financial flows and disseminating information, auditing and citizen oversight [91]

The effect of political environment on population health and its distribution was investigated by Safaei et al, 2006. He examined the explicit role of democracy (or lack thereof), along with socioeconomic covariates, on population health in a large sample of countries from across the world. He used data from the Polity IV

Project which is a highly respected source for data series on polity designed by Gurr T,R. It contains coded annual information on regime and authority characteristics for all independent states (with greater than 500,000 total population) in the global state system and covers the years 1800–2003

The democracy indicator was based on 11-point scale (0 to 10) that is derived as a weighted average from the coding of the competitiveness of political participation, the openness and competitiveness of executive recruitment, and constraints on the chief executive. Using multiple regression analysis for 118 countries on which consistent data for all the variables of interest were available, they estimated the effects of democracy along with the indicators of socioeconomic position on various measures of population. They found that overall democracy in a country was associated with increased life expectancy, reduced child and adult mortality rates. On average, the child mortality was less by between 22 to 30 per 1000, adult mortality rate was less between 77 to 79 persons (per 1,000 populations) in democratic countries compared to autocratic countries [92]. Similar results have been reported by others [93]

Community participation is an important dimension of governance. The role of community participation was highlighted during the Alma Ata declaration as part of the primary health care initiative [94,95]. Studies have been conducted to establish whether community participation can led to improved health outcomes. A study was done in Turkey by Turan et al,2006, to establish the effect of community participation on perinatal health outcomes. The researchers used a 10 step community participation process. They used five indicators to trace community participation including, knowledge, decision making, continuity, sustainability of programme and advocacy. They reported that through training of participants, all the indicators improved with community members having more knowledge on perinatal matters and ownership of the programme had continued even after the funding circle ended. However, the study did not report whether there was any improvement in health outcomes such as maternal or child mortality [96].

In India Bang T et al implemented a community based intervention to reduce infant mortality. The intervention was done in 39 intervention and 47 control villages in the Gadchiroli district of India between 1993 and 1998. In their intervention

volunteer village health workers were trained in neonatal care made home visits and managed birth asphyxia, premature birth or low birth weight, hypothermia, and breast-feeding problems. In addition they diagnosed and treated neonatal sepsis using a simplified protocols.

They found that community participation and use of trained community health workers led to improvements in child related health outcomes. Neonatal mortality reduced by 62%, infant mortality by 46% and perinatal mortality by 71%, respectively comparing intervention and non intervention communities. Case fatality in neonatal sepsis declined by 16·6%[97].

In Nepal a community participation intervention was done between 2001 and 2003 where women were trained to identify local problems with help of a facilitator. The study was done in rural villages of Nepal using a randomised controlled design where 12 communities were randomly allocated to the control or intervention. The primary outcome was neonatal mortality rate. They reported that neonatal mortality rates were lower in the intervention group by nearly 30%. (odds ratio of 0·70 (CI:0·53–0·94).Similar results have been reported in Bangladesh where community participatory approaches led to reduction in neonatal mortality rates [98].

A study was conducted in the Tigray region in northern Ethiopia between 1996 and 1998 to determine the impact of training mothers in identifying and treatment of malaria early. The study employed a cluster design with 24 clusters randomly allocated to the intervention or control arm. In intervention communities mother coordinators were trained to teach other local mothers to recognise symptoms of malaria in their children and to promptly give chloroquine. Births and deaths of children under five years were recorded monthly. The overall under-5 mortality in the intervention clusters was 29·8 per 1000 child-years compared with 50·2 per 1000 in the control clusters. Thus this community intervention led to a 40·6% reduction in the under-5 mortality rate [98].

Brinkerhoff DW et al, 2009, evaluated the impact of improved health system governance in Rwanda on health outcomes. With the support of the USA partners the Country embarked on an intervention to promote good governance in 12 districts. The aim was to improve service delivery and access to health services through

improved governance structures and decentralisation approach. The intervention started in 2005 and was evaluated in 2008. The results showed that overall, the major impacts were in three main areas: Responsiveness, accountability, and efficiency and effectiveness which improved over the period of the intervention. They also noted that after the intervention most respondents reported that training, technical assistance and equipment provided by the intervention project had led to increased planning capacity and significant improvements in the planning processes at all levels even outside the health sector. They reported increased participation of local nongovernmental organizations (NGOs), civil society organizations and even donors in the planning processes and that services were more responsive to local needs. The health outcomes reported were increase in health centre utilisation from 40% before to 91% after the intervention. Family planning acceptance also improved from 5% to 35% over the same period. The authors also reported an increase in antenatal visits and health facility deliveries [99].

2.4.5 Health information and service delivery

WHO has recognised that sound health information is vital to delivering quality health care to target population. Health information cuts across all building blocks for health system strengthening. The four key functions of health information include: data generation, compilation, analysis and synthesis, and communication and use. If well managed, Health information can help to generate timely data that could be used for policy-decision that are timely and responsive [68].

Evidence on the effect of health information including use of computer technology on the health service delivery is generally limited to few studies done in high income countries. The results have been largely conflicting with some studies showing a positive effect while others have failed to show any observable effect. In fact it has been noted that three quarters of the studies that evaluated health information have shown that they failed and showed no evidence that they improve the productivity of the health sector[100,101,102].

A study looked at use of information technology (IT) in high income countries in health care showed that application of IT among primary physicians in Australia, Canada, Germany, the Netherlands, New Zealand, the United Kingdom and the U.S.

is highly variable. The use of electronic medical records ranges from nearly all physicians in the Netherlands to only 23% and 28% in Canada and the U.S, respectively. Overall, information system capacity differed broadly by practice size with smaller practices in most countries less likely to have higher clinical information functions than larger group practices. Regardless of where they practice or practice size, physicians with high practice clinical information systems were significantly more likely to report being well-prepared to care for patients with multiple chronic diseases (OR = 1.94) and with mental health problems (OR = 1.65).They also were more likely to often use “evidence based” treatment guidelines in the care of such patients than physicians with low information system capacity (OR = 1.58). [103]

Another study looked at Diabetes follow-up to determine the impact of a physician directed, multifaceted health information technology (HIT) system on diabetes outcomes. The primary clinical measures included the change in mean value for low density lipoprotein (LDL) target <100 mg/dL or 2.6 mmol/l, blood pressure (BP) target <130/80 mmHg and glycated haemoglobin (HbA1c) target <7%, and the proportion of patients meeting guideline-recommended targets for those measures. A total of 6072 patients were identified at baseline, 70% of whom were continuously enrolled during the 24-month study. Significant improvements were observed in all diabetes related outcomes except mean HbA1c. LDL goal attainment improved from 32% to 56% (P=0.002), while mean LDL decreased by 13 mg/dL (0.33 mmol/l, P=0.002). BP goal attainment increased significantly from 30% to 52%, with significant decreases in both mean systolic and diastolic BP. The proportion of patients with an HbA1c below 7% was higher at the end of the study (P=0.008). Mean patient satisfaction remained high, with no significant difference[104]

The effect of computerised support systems in an academic paediatric intensive care unit was compared in pre and post study by Mullet et al, of very low birth weight (VLBW) babies. The sample size was 111 VLBW at pre and 100 VLBW at post study. The assumption was that medical errors could be reduced with use of computerized physician order entry (CPOE).

Results showed that after CPOE implementation, the percentage of cases during each period where caffeine was administered before 2 and 3 hours increased from 10 to 35% and 12 to 63%, respectively($p<0.01$). Accuracy of gentamicin dose at

the time of admission for 105 (pre-CPOE) and 92 (post-CPOE) VLBW infants was determined. In the pre-CPOE period, 5% overdosages, 8% under dosages, and 87% correct dosages were identified. In the post-CPOE, no medication errors occurred. They concluded that CPOE can successfully be adjusted to accommodate NICU needs and to beneficially impact clinical practice [105].

A similar study in a paediatric population looked at errors in the management of children admitted to paediatric Intensive care units. A pre and post study was done where the intervention included the use of computerized physician order entry (CPOE).Errors were classified as potential adverse drug events (ADEs), medication prescribing errors (MPE), and rule violations (RV). A total of 13 828 medication orders involving 514 patients were analyzed throughout the study period. A total of 268 patients were evaluated during the pre-CPOE study period and 246 patients were evaluated during the post-CPOE period. They reported that CPOE resulted in a 96% reduction in all types of errors associated with medication ordering. ADEs were reduced by 40% [106].Other studies have also reported positive effect of CPOE [105,106,107,108,109,110,111,112,113,114,115].

A qualitative study evaluated the use of computer-based program called Electronic medical records (EMR) to improve immunisation coverage in children. After the introduction of EMR, all the physicians and staff interviewed clearly believed that the electronic medical records (EMR) had changed not only how they managed patient records but also how they communicated with each other, provided patient care services, and performed their jobs. Most physicians and staff believed that the office environment was more organized, quieter, and less chaotic after the introduction of EMR. They recollected that the quality of documentation was better, the records were more complete, accurate, legible, and better organized. One physician commented, "If you look at the quality of my record, my problem list, my medication list, and my allergy list - they are far, far better than they ever were when I was using paper charts. Several physicians also pointed out that many of the EMR features, such as the prescription writer, health maintenance reminders, drug interaction function, and templates, were extremely useful in providing high-quality care. [116]

A study done in Zambia in selected rural and urban health centers found availability of health information and infrastructure did not improve between 2001 and 2006.The authors collected data at three levels, health facility, district and provincial levels. They conducted a baseline survey in 2001 and a follow up survey in 2006.They found that there was no significant change in the situation regarding access to health information between the 2001 and 2006.

They also reported that health workers did not seem to value the importance of health information. When they were asked to rank their basic needs, access to information was not always mentioned by health workers as one of the first priorities because it didn't seem to immediately and visibly affect the quality of service delivery.

Access to information technology including internet access was very limited. Over 90% of rural health centers had no access to internet facilities. There was lack of policy on availability of information [117].

2.4.6 Medical supplies and Service delivery

It has been acknowledged that a well-functioning health system ensures access to essential medical products, vaccines and technologies of assured quality, safety, efficacy and cost effectiveness. WHO in its framework for health systems strengthening has emphasised the importance of this building block. In many respects, monitoring the performance of this building block is intricately related to other building blocks like governance, health information, finance and service delivery [118].

As early as 1977 when the World Health Organization (WHO) produced the first Model List of Essential Drugs and as part of the Alma-Ata declaration in 1978, WHO and its partners committed to provision of essential drugs which was one of the elements of primary health care. Despite such commitment over three decades ago, the number of people without access to essential drugs is estimated to be about 2 billion which is approximately one third of the world [119,120]. The distribution of pharmaceutical consumption remains highly in favour of high income countries. A study commissioned by the WHO to look at the world Medicine situation reported

that in 1999, 15% of the world's population which lives in high-income countries purchased and consumed about 90% of total medicines by value. They also observed that the market share of the USA alone rose from 18.4% of the world total in 1976 to over 52% in 2000.This is in sharp contrast to low-income countries where the share of pharmaceuticals consumed fell from 3.9% of the total in 1985 to 2.9% in 1999. The report also showed that countries with low access to medicines had relatively very low disability-adjusted life expectancy compared to countries with very high access to medicines which also had better disability adjusted life expectancy [121].

Providing universal access to effective medicines and vaccines requires coordinated health system. The processes are complex yet interdependent. They include production, selection, procurement, and distribution of good quality pharmaceutical products. At health facility level, correct prescription and dispensing and at patient level correct use. In addition, adequate financing and effective monitoring of the system is equally important to ensure consistent supply [122].The policy environment is also crucial to ensuring access to drug and vaccines.

Developing countries select vaccines and drugs based on policy guidelines from WHO and adapted to local contexts [121,123]. WHO's World Medicines Situation survey showed that the number of countries with a national policy on medicines increased from only five in 1985 to 108 in 1999. Unfortunately the report also noted that two-thirds of the countries with a medicines policy document (official or draft) had failed to establish an implementation plan by 1999 [121]. The distribution chains remain very poor in sub Saharan countries with poor regulations of the pharmaceutical industry especially in the private sector [124]. A study from four East African countries pointed to the fact that there was inadequate capacity for managing medicines and related commodities in the region despite rapid increase in provision of ART [125].

Measuring access to drugs and other medical products possess substantial challenges. Studies looking at the impact of improved supply chains of medical products and vaccine are very few and tend to describe the process rather than the health outcomes.

Over prescription and misuse of medicines are widespread practices in health systems [126]. Literature indicate that 25 to 75% of antibiotic prescriptions in teaching hospitals are inappropriate and 30 to 60% of patients in primary health care centers receive unwarranted antibiotics prescriptions and less than 50% of people with chronic illnesses such as diabetes and hypertension adhere to prescribed treatment [119]. Studies done in low income countries reviewed that inappropriate prescriptions are very prevalent. For example, in Ghana the average number of drugs prescribed per encounter was 4.3, which was the highest and exceeded the figures reported from Asia, Latin America and the Caribbean countries [127].

It has been suggested that improvement in medical supply and prescription can result in great savings for the health system [128].This has led to initiatives to improve prescription patterns in low income and middle income countries.

A randomised trial was conducted in Zambia aimed at evaluating the impact of three continuing education seminars (within a period of 4 months) on the quality of patient management and rational drug use. In this study, prescribers in 16 urban health centers were allocated to an intervention (eight health centers) or a control (eight health centers) group. A total of 5,685 patient cards were analyzed for quality of case management and rational drug use. The results showed tremendous improvement in the prescription patterns in the intervention group. The mean number of drugs per patient decreased in the intervention health centers from 2.3 before to 1.9 after the intervention ($p = 0.005$). Among children an average of 2.5 drugs per patient was prescribed before intervention and this decreased to two drugs after intervention. A decrease in the mean number of drugs per patient from 2.2 to 1.8 was noted among adult patients in intervention centers. No change was observed in the control health centers for children or adults. The proportion of patients receiving non pharmacological treatment also increased from 1.9% to 13.2% in the intervention group. A reduction in prescription of antibiotic was also reported in the intervention group [129].

A pilot study by the World Bank group, 2010, was conducted in Zambia to establish whether improved supply chains could lead to improved availability of essential drugs. The study was done in 16 districts which were divided into intervention and control intervention districts. After two years of the intervention, they

reported that in districts where supply chain improvements were introduced, availability of paediatric malaria drugs was better. In the intervention districts, paediatric malaria drugs were available 345/365 days with an average downtime of only 20 days. While in the control districts, the availability was just 247/365 days. They also reported that the availability amoxicillin was higher in intervention compared to control districts (92%vs 63%). Similarly, improvements were observed for all essential drugs and supplies including malaria prophylaxis for pregnant women and Sulfadoxine-pyrimethamine. This study showed that improved supply chain could lead to improved availability of essential pharmaceutical supply but did not report whether this led to improved health outcomes [130].

2.5 Challenges of providing comprehensive evaluations

Strong health systems are important in providing quality and equitable health care for all. (Evans et al. 2008). In recent time, donor support and investments towards improvement in health systems has increased. [131]. This new wave of investment in health require robust intervention designs and evaluations that could provide crucial answers with regard to the system-wide effect of such interventions. [9,132,133]. It remains a fact the poorly designed interventions and evaluations lead to wrong policies and could discourage new investment in health [2,53,134]. Recent reviews have demonstrated that most evaluations are too narrow even when initial design provides for potential to answer system-wide questions [2,135].

The complexity of public health systems require system-wide approaches when conducting evaluation [135]. It is therefore timely to call for paradigm shift in framing research questions, designing and evaluating interventions[66]. In its recent publications WHO has been advocating for using systems wide approaches such as systems thinking to guide intervention design and evaluation [2,136,137].

2.6 System wide designed intervention with narrow evaluation scope: Current Evidence from Sub Saharan Africa

Several complex interventions conducted in recent time in Sub-Saharan Africa targeted more than one health system building block yet the evaluations have tended to be narrow[138]. We reviewed some studies highlighting the components of health system targeted in the design and compared this to the scope

of evaluation results reported. The aim is to highlight missed opportunities for providing system-wide evaluations.

2.6.1 Country specific evaluations and Scope:

A study done in Mozambique by Beran at al, 2010 to evaluate the impact of the UK and Mozambique twining program targeting diabetes and non-communicable diseases had a system wide intervention design targeting six building blocks of health system to strengthen diabetes and other non-communicable disease management in Mozambique. The evaluation of this project reported on human resources in terms of number of health workers trained, service delivery in relation to awareness and use of services and governance of the project. Impact on other building blocks was not reported.[139].Another study in Mozambique with system wide intervention to improve information quality targeted all health building blocks. However, the evaluation only reported on human resources and health information[140].

Another study with a system-wide perspective was conducted in Nigeria targeting EPI program implementation. The program targeted all six building blocks of the health system with the aim of improving immunization coverage. In their evaluation the authors reported only service delivery and governance issues of the program[141].

In Kenya a system wide intervention targeting delivery and effect of Hib vaccine was conducted. Though the study components essentially included all health system building blocks in the design the evaluation was done for only two building blocks i.e. service delivery as it related to change child mortality and finance in terms of cost per vaccine dose delivered[142].Similarly, Kilonzo et al,2009 conduced a complex intervention to reduce risk of HIV infection in rape victim in Kenya. The intervention included service delivery, human resource, medical supplies information system, governance and finance. Nonetheless, their evaluation focused only on service delivery, governance and the cost of the intervention[143].

In Niger a complex intervention targeting service delivery finance, medical supplies, health information, governance and human resources was conducted. An

evaluation of this intervention reported effect in terms of serviced delivery, governance and finance. Other components were not evaluated at all.

In South Africa, a system wide intervention to improve delivery of PMTCT program was designed. All the components of health system were strengthened at municipality level. The evaluation of this intervention only reported on service delivery and health information[144].

Meyer et al, 2001 conducted a study where the intervention included four health system building blocks these were medical supplies, human resources, service delivery and governance. In their evaluation the authors reported only two building blocks service delivery in terms of specific disease management and medical supplies in relations to change in prescribing behaviours of health workers comparing the control and intervention groups [145].

Were et al, 2011 implemented an intervention that included medical supplies, service delivery, human resources and health information in form of computerized reminders to clinicians compared to standard practice. In their evaluation they only reported the intervention effect in health information improvements ignoring other related building blocks such as human resources and finance. [146]. Similarly, Kegira et al,2011 reported effect on health information after conducting an intervention that targeted at last five building blocks (health information, human resource, medical supplies, governance and service delivery. [147].

In Uganda an intervention focusing on health information, service delivery, human resources only reported effect on service delivery. [148].Another Ugandan study targeting human resources, service delivery, financing ,health information only reported service delivery and human resources after evaluation[149].Courtright et al, designed an intervention to improve eye services was in rural Uganda. The intervention included all building blocks of the health system. The evaluation of the intervention only mentioned governance and service delivery[150].

In South Africa an intervention targeting human resource, health information, finance and service delivery in an HIV program reported effect in service delivery in terms of patient outcomes and costs of the program delivery. [151]. Another study

conducted in South Africa targeted young people in school with HIV prevention intervention While the design included service delivery, human resources and medical supplies, the evaluation only reported effect in service delivery showing that the intervention had increased user efficacy of condoms and differential impact by gender. The effect on other building blocks were ignored despite their close links with the reported building blocks..[152]

In Zambia a study was done to evaluate the effect of policy change where the government abolished user fees for health care in Zambia in 2006. The new policy had system wide implication and hence its evaluation had potential to report the effect across all health system building blocks. In the 15 months post intervention evaluations the authors reported on service delivery in term of change in utilization and also briefly described impact of drug supplies and human resources[153].

2.6.2 Multi-Country evaluation and scope

The PEPAFR program was another program with multifaceted interventions aimed at improving delivery of HIV treatment and prevention in Sub Saharan Africa. In effect the program targeted all health system building blocks. However, most reported program evaluation of PEPFAR programs have been fragmented with some studies only reporting service delivery, medical supplies and finance building blocks [154].While others focused on governance, service delivery and medical supplies[155]. One recent evaluation of PEPFAR reported on Service delivery only in terms of effect on health outcomes[24] despite the multifaceted nature of the intervention and the links between them.

A multi-country study was done in six Sub Saharan African countries looking at a multifaceted intervention targeting child health through promotion of Child health day(CHD). This intervention had system wide design that included the human resources, service delivery, health information, medical supplies, governance and finance building blocks. However, the evaluation reported on three building blocks only service delivery finance and Human resources[156]

A study was conducted by Monda et al, 2012 in Sub Saharan region. The study components included health information, service delivery, governance and

finance. However, the evaluation of this program only reported effect in terms of change in quality of data and its feasibility in low income settings[157].

A systematic review by Adam et al,2012 which aimed to identify studies that have used comprehensive evaluations focusing on more than one building block of health system revealed that .despite the high proportion of studies that involved complex interventions the nature of the evaluations and the type of impact assessed did not reflect that complexity[138]. Out of 106 studies included in their review more than 50% assessed only one building block even when the intervention targeted more than one building block. Less than 10% explored the impact of the intervention across three or more building blocks. They also found that most evaluations of complex interventions did not ask broader questions that allowed for system assessment of the effect and that only 24% included process evaluation and only 9% included context analysis. Majority did not refer to any theoretical framework at all[138].

Several other studies conducted in sub Saharan Africa have shown similar limitation in terms of reporting bias focusing only on selected health system building blocks especially service delivery[138].

2.7 The study rationale: summary of the main findings from the literature

"*When we try to pick anything by itself, we find it hitched to everything else in the universe!"* ***(John Muir, 2008)***

1. There is no consistent definition of "health systems" and "health system strengthening" in the literature. Different organisations define health systems and health system strengthening differently.

2. Health system evaluation frameworks have undergone tremendous evolutions overtime but there seems to be consensus based on common elements within different frameworks.

3. The literature review on health system building blocks showed that most studies have looked at building blocks in isolation in trying to explain health outcomes. For example, studies have looked at human resources, financing, and governance, drug supply and health information in isolation and how these individually affect service delivery. Yet they acknowledge that other building blocks could be important in explaining the observed outcomes.

4. The results on evaluating single building blocks have given contradictory results about the relationship between building blocks and health outcomes. Some have demonstrated some effect while others have not.

5. Most studies done about health human resources and health outcomes have been done on macro level with less consideration for local contextual factors at micro level.

6. Literature on two building blocks (Governance and medical supplies) in relation to impact on health service delivery or health outcomes is limited.

7. The study design for most of the evaluation on the effect of health system building blocks and impact on health outcomes are mainly observational and

retrospective. There are few randomised trials raising concerns about the potential confounding

8. Few studies have used short term process indicators like health service delivery as an outcome, most focus on mortality which may take time to observe unlike the former

9. There is lack of documentation of the processes and pathways leading to the observed outcomes (Black box tendencies).This makes it difficult to determine why some interventions fail or succeed. In the absence of process documentation, it is not easy for others to replicate similar interventions in other settings.
10. Data from Sub-Saharan Africa is limited on many building blocks

11. Contamination of effects to the control sites is a real danger in community trials

12. Most of the studies have assumed that other sub-systems are static or have no contributions, which is not true.

13. Evidence from literature review on comprehensive evaluations showed that while most intervention targeting public are inherently complex this in is not reflected in most designs and evaluations of such complex interventions. While some attempts have been made to include more building blocks in intervention designs the corresponding evaluations have failed to capture this.

Study Rationale

The literature review showed narrow scope in the design and evaluation of most complex health systems. Most of the evaluation tended to be fragmented and attempted to evaluate one or limited building blocks at any given time. Interestingly, most studies also agree that there are other factors in the health system that can affect the relationship between building blocks and health outcomes. Hence the need to provide comprehensive evaluations that take into account the complexity and linkages across building blocks in explaining health outcomes. The lack of common framework and indicators make it difficult to assess and compare health systems performance[39]. It is therefore important to provide a common framework for guiding the design and evaluation of such complex interventions based on theory and to develop common indicators to assessing the effect of health system strengthening interventions[39,158].

2.8 Objectives and study Questions

Primary Objective of the BHOMA intervention

The primary objective of the BHOMA intervention is to reduce age adjusted adult mortality in the target districts [159].

The Secondary objectives are:

1. To understand the causal pathways of the BHOMA interventions by analyzing inputs, outputs, process and outcomes
2. To measure the cost of the BHOMA interventions
3. To measure whether the health system has been strengthened by the BHOMA interventions

This thesis is focused on secondary objective number 3: To measure whether the BHOMA intervention has strengthened the health system in the target districts. The specific objectives explored in this thesis were:

1. To develop indicators for marking the performance of a strengthened health system
2. To determine the effect of the BHOMA intervention on the health system in the target districts
3. To explore the important processes, contextual and system factors that could explain the observed changes

CHAPTER 3

3 METHODOLOGY

3.1 The general description of the BHOMA project

The Better Health Outcome through Mentorship and Assessment(BHOMA) is one of the African health Initiative projects funded by the Doris Duke Charitable foundation in 2009.The overall aim of the funding was to improve overall population health in five target African countries[160].

The BHOMA intervention targeted to reduce adult and child mortality in three Districts of Zambia. The secondary objective was to strengthen the health system and to document the processes involved in achieving the intervention effect.

The BHOMA intervention was funded in 2009. The piloting of the intervention was done 2010 and the roll out of the intervention commenced in mid 2011 after the baseline. The intervention is expected to be completed in 2014. This thesis is nested within the BHOMA intervention focusing on health facility surveys at baseline and 12 months follow-up. The baseline was conducted in 2011 and the 12 follow-up study was conducted in 2012 when 24 health facilities were in the intervention while 18 were in the control phase.

3.2. Target districts

The BHOMA intervention is being conducted in Chongwe, Luangwa and Kafue districts which are all considered rural.. The intervention was to be delivered at health facility level and therefore was designed as a cluster randomised community trial. The study has a stepped wedge design where the intervention is being rolled-out gradually until all the 42 health facilities receive the intervention. The unit of randomisation was the health facility and its catchment population.

3.3. The BHOMA districts: Chongwe, Kafue and Luangwa

Better Health Outcomes through Mentoring and Assessment (BHOMA) project covers three districts within Lusaka Province. These are Chongwe, Kafue and Luangwa districts. There are a total of 55 government health care facilities in the BHOMA districts: 29 in Chongwe, 17 in Kafue, and 9 in Luangwa. This count

includes four mission facilities, which are supported in part by MoH financing, and supplemented by specific denominations or through coalitions of church providers. In 2008, Chongwe health centres reported 270,914 patient visits; Kafue reported 303,223 visits; and Luangwa reported 69,396 visits. Approximately one-third of all visits are for children under five years in Chongwe (33%) and Kafue (31%), with the proportion slightly higher in Luangwa (39%). In the target districts there were in total 48 eligible health facilities with a total population of 306,000. Six (6) were used for piloting the intervention and 42 were randomised to receive the intervention.

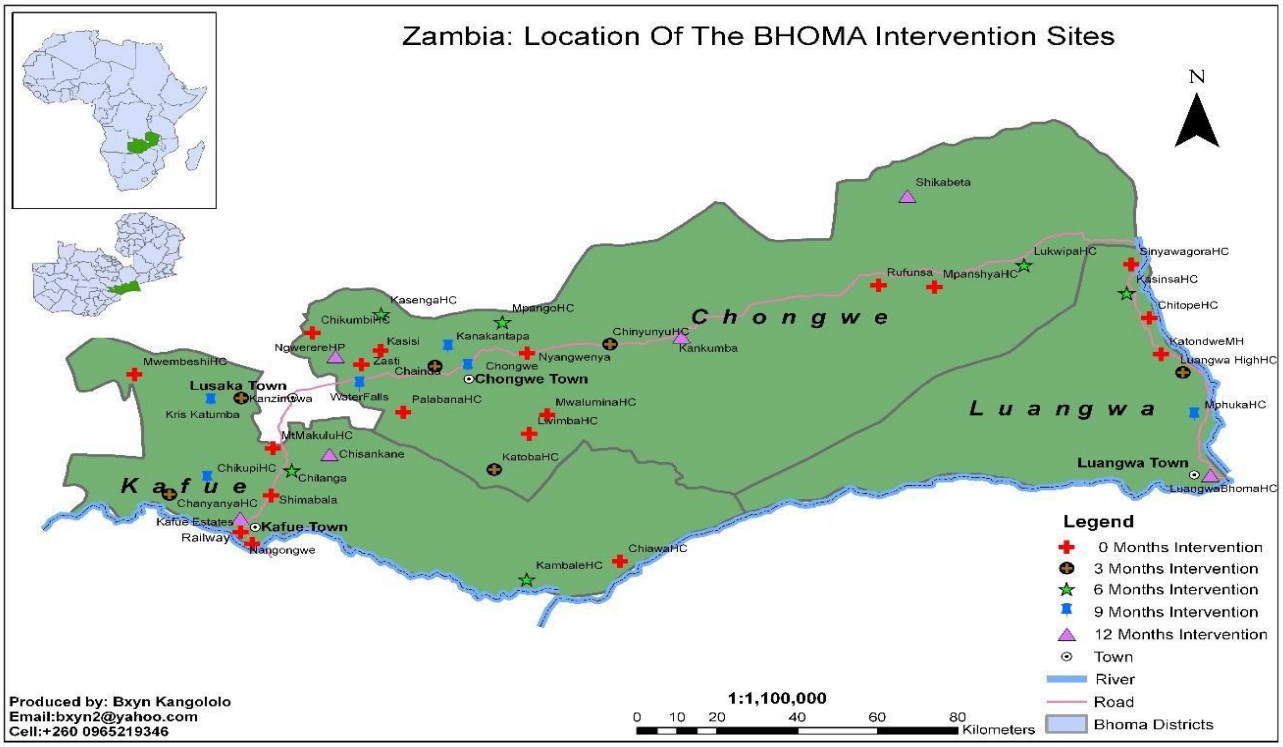

Figure 3 Showing the BHOMA districts and intervention and control sites

3.4. Intervention design

The intervention commenced in April 2011 when the first set of health facilities received the intervention. All the health facilities are expected to receive the intervention my mid-2013.The final evaluation of the BHOMA intervention will be in 2014. The BHOMA intervention is made up of three primary strategies designed to work at different levels of the health system. These are district, health facility and community strategies. The full intervention is presented in another paper [[159] and research paper 1. Following is a summary description of the three BHOMA strategies:

3.5. The district intervention

In each of the three districts there is one Quality Improvement (QI) team which implements the intervention in target health facilities. Each QI team consists of two nurses and one clinical officer. The teams work closely with the Ministry of Health.

3.6. The health facility intervention

The health facility-based intervention was designed to improve clinical care quality at health facility level through providing practical tools and establish standardised protocols to guide clinicians during consultations. This was done through intensified training and support from the implementation team. Each health facility is able to generate summary reports for self-assessment and to use the report to highlight areas for further improvement. The report is also used by the implementation team for mentoring health workers. Leadership training is provided to the health workers targeting governance, finance, supply chain, health information and human resource management. Staffing support is made up of the newly recruited lay workers known as “clinic supporters”. These have been trained to do most non-clinical duties that include patient registration, filing of patients’ records, checking vital signs such as blood pressure, pulse and temperature. They also facilitate fast tracking of patients that need urgent attention.

3.7. The community intervention:

The BHOMA project has engaged community health workers on part time basis. They are trained in providing preventive services and tracking missed clinic appointments. They work in collaboration with community health units known as Neighbourhood Health Committees (NHCs) and Traditional Birth Attendants (TBAs).The community health workers are also being trained in capturing and recording local health data and sending it to health facilities via mobile phones or physically.

3.8. Randomisation and rollout plans

There were 48 eligible health facilities in the three BHOMA districts. Six health facilities were used for piloting the intervention.. The remaining 42 health facilities

were randomised in the order of receiving the intervention in a step wedge fashion until all receive the intervention. Six facilities were randomised to start the intervention in each step and each step took three months to implement. Randomization was stratified by district.

Randomisation was done by a statistician from London School of Hygiene and Tropical Medicine who had no prior knowledge of the study sites. Randomisation was stratified by district.

3.9. Intervention piloting

Before the intervention was implemented it was piloted in 6 health facilities which were not included in the final randomization of the health facilities. Each target district had two plot sites. The piloting of the intervention was done in 2010.Lessons learnt were used to adapt the intervention making it more applicable to the local settings.

3.10. Implementation and evaluation teams

In order to ensure objective evaluation, the BHOMA study has separate implementation and evaluation teams. The intervention implementation is being done by the Centre for infection disease research in Zambia (CIDRZ).

The evaluation is being done by the Zambia AIDS related Tuberculosis (ZAMBART) supported by London School of Hygiene and Tropical Medicine. There is a close collaboration between the implementation and the evaluation teams to ensure that the evaluation is tailored to the intervention and to adapt the intervention according to the results of the on-going learning process.

3.11. Evaluation design

Robust evaluation of any intervention effectiveness depends on the study design and the extent to which the design controls for possible confounding. The gold standard is a randomised clinical trial (RCT) for intervention targeting individuals or its variant known as cluster randomised trial (RCT) for intervention offered at cluster or group level. The BHOMA intervention was designed as a clustered randomised trial as the intervention was centered around each health facility and the

population attending the health facility. Furthermore, as the intervention was deemed beneficial but also labour intensive, it was rolled over a period of time so that all health facilities receive the intervention over 4 years. The BHOMA intervention was therefore designed as a “stepped wedge” randomised cluster trial.

The use of RCT in the BHOMA is simply a starting point and this being a complex intervention implies that causal pathways and assumptions of RCT may not hold true in these real life settings and hence the need to complement RCT with process evaluation and qualitative methodologies that could facilitate a comprehensive evaluation requiring application of system wide approaches such as systems thinking [135]. [161].

3.12. Health facility surveys:

Health facility surveys are conducted annually in the 42 target health facilities. Both quantitative and quality methods are used to collect the data. Specific tools and approaches used are described in the individual research papers. Here we give a general approach to data collection and analysis

3.12.1. Quantitative data:

Data collection

At each health facility a number of questionnaires were administered targeting health facility managers, health workers and patients. Tools for data collection were adapted from the WHO Measure Evaluation facility surveys and Health Facility Assessment Network (HFAN)[162]. Data capture followed WHO health building blocks on health system strengthening including governance, finance, human resources, health information, Medical supplies and service delivery[40]. Contextual factors were also captured during the annual facility surveys.

Target population

At each health facility, managers and person’s in-charge of health information, drugs and medical supplies, financing were interviewed. At least two non-managerial health workers were interviewed separately to get an independent view of services being provided by the health facility. Clinical observations and exits

interviews were conducted at each health facility. Five (5) observation and five (5) exit interviews were conducted for Children and adult services separately.(*See appendices :13.1.1-13.1.8).*

Data analysis

Data were double entered onto an Access database and exported to SPSS version 19 or STATA version 12 for analysis. Simple frequencies were used to analyze and explore the data. Comparisons were made between health facilities and districts based on the modified balanced scorecard system. The analysis utilized indicators reflecting the 2011 MOH Strategic Plan. These were service delivery, human resources, finance and other service capacity (basic infrastructure, basic equipment, laboratory capacity, tracer drugs and infection control).

Patient and community perspectives were elicited through exit interviews which were separate for children and adults. Gender differences in service satisfaction were used to assess equity of access as reflected the vision of the Ministry of health in Zambia. This was taken as a proxy to overall vision as required when applying balanced scorecard approach.

3.12.2. Qualitative data:

We used qualitative methods to collect information from managers and the community. The qualitative studies were conducted in purposefully selected health facilities.

Target Groups

Focus group discussions (FGDs) were conducted for men and women above the age 18 years. They were eligible if they had lived in the catchment area of the health facility for at least 3 months. Each focus group was made up of 6-10 participants. Men and women were interviewed separately

Selection of FGD participants

Community groups were organized with the help of local leaders and community health representatives who mainly informed community members about

the dates and time of the interview. Attention was paid to the group heterogeneous characteristics, i.e. different occupations, social networks, educational status. All group discussions were held away from the health facility to avoid influence from the health workers .All interviews were recorded and later transcribed by trained research assistants familiar with qualitative methods. The transcribed material was validated by the team leader.

Key Informant Interviews

At health facility level the main key informants were health facility in-charge, Neighbourhood health committee chairperson (NHC). At district level the key informants included clinical care specialists and directors of health in target districts.

Data collection tools

The themes and questions were based on literature and reported challenges in the Zambian health system. The questions were pre-tested in pilot health facilities within the BHOMA intervention and adapted to reflect the Zambian health care settings. Focus group discussion guides were translated into local languages spoken in study sites. Key informant interviews were conducted in English except those for community representatives who were interviewed in Nyanja or Chewa. Questions covered the six building blocks for health system from both demand and supply side. *(See appendices: 13.1.9 &13.1.10)*

Analysis of qualitative data.

Data was transcribed by trained research assistants familiar with qualitative methods. All scripts were checked and validated by the main researcher. Transcripts were cleaned and exported to Nvivo for analysis. Coding was done by the main researcher and checked by the second researcher experienced with qualitative methods. Data coding followed pre-determined themes based on health system building blocks..

3.13. Ethical considerations

The study was approved by the University of Zambia Bioethics Committee and the London School of Hygiene and Tropical Medicine Ethics Committee. All

participants were informed about the purpose of the survey and were asked to sign a consent form before taking part in the study. Confidentiality was ensured during data collection and subsequent publication of the results.

3.14 **Describing the process and linkages between papers:**

This thesis aimed to answer the following three specific research questions:

1. What indicators could be used for marking the performance of a strengthened health System?
2. What is the effect of the BHOMA intervention on the health system in the target districts?
3. What are the important processes, contextual and system factors that could explain the observed changes?

In addressing research question number 1, we first searched the literature and reviewed documents from WHO, Measure evaluation and the Ministry of health in Zambia. Through this process we developed an initial list of indicators for measuring health system performance. These indicators are summarised in annex 13.2.14.

We tested these indicators in the BHOMA pilot sites. We then applied these indicators for ranking the performance of the target districts at baseline. Three research papers in this thesis addressed the first research question concerning the development of appropriate indicators. These were research papers 2, 3 and 4.

Research paper 2 focused on validating the indicators for measuring health worker motivation while research paper 3 validated the indicators for measuring health system governance. Research paper 4 summarised all the indicators from research papers 2 and 3, in addition to other health system indicators in a balanced scorecard.

In order to provide baseline contextual factors and linkages across the health system building blocks, a qualitative study was also conducted at baseline. This is reported in Research paper 5.

The intervention was then implemented for 12 months. At the end of 12 months, 24 health facilities had received the intervention while 18 were in the control phase. We conducted a follow-up study to answer research question number 2 concerning the effect of the BHOMA intervention on the health system in the target districts. We used indicators developed at baseline which were summarised in a balanced scorecard. We compared intervention and control sites based on the domains of the balanced scorecard. The effect of the BHOMA intervention after 12 months of intervention implementation are presented in research paper 6.

In order to understand the processes and the contextual factors which were important in explaining the effect of the BHOMA intervention, we developed a theoretical framework based on recommendations from WHO on application of systems thinking in evaluation of complex health interventions. This theoretical framework was developed in consultation with stakeholders in the target districts. It highlighted the anticipated effect of the BHOMA intervention both positive and negative and the linkages cross health system building blocks using feedback loops. This theoretical framework is presented in research paper 1. It formed the basis for the 12 months follow-up qualitative study which applied systems thinking principles to examine the important processes and the contextual factors that had an influence on the effect of the BHOMA intervention. The findings are presented in research paper 7, which addressed research question number 3.

3.15. Research paper 1:

Title: Systems thinking in Practice: Proposed approach to evaluation of the six WHO building blocks for health system strengthening: A methodological paper.

For a research paper prepared for publication**:**

Where is the paper intended to be published: **Plos One**
Stage of publication: **Submitted**
Have you retained the copy right for the work: **Yes**
If yes attach evidence of retention
http://www.plosone.org/static/license: PLOS applies the Creative Commons Attribution License (CCAL) to all works published. Authors retain ownership of the copyright for their article, but authors allow anyone to download, reuse, reprint, modify, distribute, and/or copy articles in PLOS journals, as long as the original authors and source are cited. **No permission is required from the authors or the publisher**

For multi-authored work give full description of your role in the research and preparation of the paper:

I was a lead researcher on health system evaluation on the BHOMA project. I developed the systems thinking theoretical framework and drafted the manuscript and was the lead author.

Candidate Signature:

Supervisor or senior author's signature to confirm roles as stated:

Application of system thinking concepts in health system strengthening in low income settings: A proposed conceptual framework for the evaluation of a complex health system intervention: The case of the BHOMA intervention in Zambia

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Abstract:

Background: The current drive to strengthen health systems provides an opportunity to develop new strategies that will enable countries to achieve targets for millennium development goals. In this paper we present a proposed framework for evaluating a new health system strengthening intervention in Zambia known as Better Health Outcomes through Mentoring and Assessment (BHOMA).

Approach: We briefly describe the intervention design and focus on the proposed evaluation approach through the lens of systems thinking.

Discussion:

In this paper, we present a proposed framework to evaluate a complex health system intervention applying systems thinking concepts. We hope that lessons learnt from this process will help to adapt the intervention and limit unintended negative consequences while promoting positive effects. Emphasis will be paid to interaction and interdependence between health system building blocks, context and the community.

Introduction

One major breakthrough in understanding the complex world of organisations is from systems theory. Systems theory underscores the importance of looking at systems from a broader perspective rather than simple parts which make up the system[1]. Where reductionists would like to dissect a complex process and study the individual parts separately, systems theory highlights the importance of understanding the complete system and the underlying interactions of all the forces that make up that system [1,2,3]. Systems theory has greatly influenced the way we understand and change organisation performance [4,5]. The theory was introduced by Ludwig von Bertalanffy in the 1940s in when he described systems theory as a general science of wholeness [2].

The application of this theory is called systems analysis. One of the major tools of systems analysis is systems thinking [3]. In simple terms, systems thinking is a way of helping an individual to view systems from a broad perspective that includes seeing overall structures, patterns and cycles in systems, rather than seeing only specific events in the system [3,4].

Systems thinking has been applied in diverse fields such as engineering, economics and ecology. Such work has shown that systems are constantly changing, with components that are tightly connected and highly sensitive to change elsewhere in the system. They tend to have non-linear relationships and usually unpredictable [3,6]. Systems are often resistant to change, with seemingly obvious solutions sometimes worsening a problem [1,5].

To understand and appreciate the relationships within systems, several recent projects have adopted systems thinking to tackle complex health problems and risk factors. Systems thinking has been applied in tobacco control, obesity and tuberculosis research [5,6,7].However, the application of systems thinking at broader level of health systems has remained untapped [8].

According to a recent WHO publication [8], systems thinking can open powerful pathways to identifying and resolving health system challenges and as such is a crucial ingredient for any health system strengthening. In evaluation of health system building blocks which include; service delivery, health workforce, information, medical products and technologies, financing, and governance, WHO has been advocating for the adoption of systems-wide approaches such as systems thinking [6,9].

Julio Frenk has argued that part of the problem with the health systems debate is that too often it has adopted a reductionist perspective that ignores other important aspects [10]. It is therefore important that future interventions and evaluations take a more comprehensive view that expands and challenges the status quo [6,11]. In this regard, there is need to apply systems thinking in the design and evaluation of health system strengthening interventions. It is crucial to systematically explore the interconnectedness between different building blocks. Systems thinking opens the opportunity to discover both intended and unintended consequences of any health intervention[9,12]. This dynamic view, entails looking at actors and actions as the building blocks interact with each other but also with the target population in which the intervention is being implemented [6,9,10].

In this paper, we present the proposed framework for evaluating a complex health system intervention in Zambia known as Better Health Outcomes Through Mentoring and Assessment (BHOMA), applying system thinking concepts looking at intended and unintended consequences [6]. The aim is to provide an evaluation plan that is adaptive and responsive to the intervention and context. This process is essential especially that the intervention is being applied in a complex adaptive health care system [6,9]

Designing an Intervention on the basis of systems thinking: The Better Health Outcomes through Mentorship and Assessment (BHOMA)

Zambia is one of the countries that are lagging behind in achieving millennium development targets. Several barriers have been identified as hindering the progress towards health related millennium development goals. These include socio-cultural practices, poor referral systems, limited health infrastructure and lack of qualified health human resource. These barriers limit access to health services especially in rural areas. Designing an intervention that addresses these barriers was crucial and with calls for systems strengthening high on the global agenda, the BHOMA project was born with the current challenges in the Zambia's Ministry of Health (MoH) in mind and the need to provide a system wide solution rather than disease specific.

The BHOMA project is a randomised cluster trial that aims to strengthen the health system in three rural districts of Zambia, namely Chongwe, Kafue and Luangwa covering 48 health facilities (6 pilot sites and 42 intervention sites).The trial has a stepped wedge design where the intervention is being rolled out "stepwise" at

specified time interval until all eligible health facilities receive the intervention. The overall end point of the trial is the reduction in age-adjusted adult mortality rate.

The BHOMA model is made up of three primary strategies, designed to work at different levels of the health system. These are district, health facility and community strategies. Following is a summary description of the three BHOMA strategies:

The district strategy

Each of the three districts has one Quality improvement (QI) team that implements the intervention in target health facilities. Each QI team consists of two nurses and one clinical officer. The QI teams have undergone advanced clinical and quality improvement training. The teams work closely with the district clinical care specialist who represents the interest of the Ministry of Health. The district QI team is supported by the central Quality Improvement team that provides technical and logistical support to the district teams. The district team implements the intervention in target health facilities in step wedged fashion. At the health facility, the QI team works intensively with local clinic staff to build clinical skills, applying clinical protocols and algorithms, completing forms, and reviewing patients together. They work one-on-one to mentor health workers about good patient consultation, ordering appropriate investigations, interpreting results, and working through diagnoses.

The health facility strategy

The health facility-based intervention targets improvement in clinical care quality by implementing practical tools that establish clear clinical care standards. Resources are provided to meet these standards with support from the QI team. As part of self assessment, each clinic generates reports that help to identify areas of weakness for further improvement. Training and mentorship is provided to health workers targeting patient consultation, checking for danger signs and management of common illnesses. Additional training is provided in governance, finance, supply chain and human resource management. The main human resource support consists of community workers trained as “Clinic Supporters.” These lay workers are trained to assume as many non-clinical duties as possible. These include registration of patients, filing, triaging, recording vital signs, fast tracking urgent cases and routing patients through services.

The community strategy:

The BHOMA project has engaged community health workers on part time basis. They are trained in providing preventive services and tracking missed clinic appointments. They work in collaboration with community health units known as Neighborhood Health Committees (NHCs) and Traditional Birth Attendants (TBAs). The community health workers are also being trained in capturing and recording local health data and sending it to health facilities via mobile phones or physically. Community health workers work with NHCs and TBAs to increase community awareness and participation in health programmes. Figure 1 summarises the components of the BHOMA intervention.

Implementation and evaluation teams

In order to ensure objective evaluation, the BHOMA study has a separate implementation and evaluation teams. The intervention implementation is being done by the Centre for Infection Disease Research in Zambia (CIDRZ).

The evaluation is being done by the Zambia AIDS related Tuberculosis (ZAMBART) supported by the London School of Hygiene and Tropical Medicine. There is a close collaboration between the implementation and the evaluation teams to ensure that the evaluation is tailored to the intervention and adapt the intervention according to the results of the on-going learning process.

Evaluation design for the BHOMA Intervention

Rigorous evaluation of any intervention requires careful study design that takes into account possible confounders. The recommended gold standard is a Randomised Clinical Trial (RCT) design as it ensures that intervention and control groups are comparable on as many factors. Though RCTs may have their advantages, they equally have well recognised pitfalls and limitations [13,14]. RCTs were designed to randomise large numbers of people into control or intervention arms, often aimed at addressing narrowly specified questions with the goal of maximizing internal validity [14].This is often different from health system interventions which are usually delivered to groups, clinics, facilities or as districts and the intervention may have multiple goals and questions. In addition, the heterogeneity in the baseline characteristics of the study units of a health system, implies that sources of error may be inherent to specific health facilities [13]. It has been recognised that health systems are complex and dynamic [6]. It is usually not simple to isolate the cause and effect [6]. The BHOMA intervention being centered around the catchment population attending one

health facility is suitable for evaluation through a cluster-randomized approach. However, the intervention is complex and labor-intensive and therefore must be rolled-out gradually, from one clinic to the next over a period of 5 years. This makes the intervention amenable to evaluation through a variation of the cluster-randomised design, known as “stepped wedge”.The use of RCT in the BHOMA is simply a starting point and this being a complex intervention implies that causal pathways and assumptions of RCT may not hold true in these real life settings. Hence the need to complement RCT with process evaluation and qualitative methodologies that could facilitate a comprehensive evaluation, requiring application of system wide approaches such as systems thinking [7,12]. This will enable the intervention to be monitored and evaluated for both intended and unintended consequences as well as reporting contextual factors that facilitate adoption or failure of the intervention [6,9].

We shall use a modified health system building blocks framework to guide the evaluation process. Emphasis will be placed on the interaction and interdependence across and within building blocks from a systems thinking perspective. We will also look at how the demand side of health services (community) interacts with the intervention given the context in which the intervention is being implemented. We hope to demonstrate the pathways through which the intervention will act to achieve the outcome of interest (age adjusted adult mortality rate).The changes will be followed from both demand and supply side perspectives.

Hypothesis: Impact or causal pathways

We believe that the intervention will act both by “push” and “pull” mechanisms. By improving clinical care at the health center we believe that the community will be drawn to better services and that this increased utilization will also be pushed from the community side by better health outreach and information through the community package in the BHOMA intervention.

Main study question:

1. What indicators can be used to mark the performance of a strengthened Health system?
2. What is the effect of the BHOMA intervention on the health system in the target districts?
3. What are the important processes, contextual and system factors that could explain the observed changes?

The BHOMA intervention is a complex health system intervention which targets the building blocks for health system strengthening. It is therefore important to anticipate how the intervention might flow through, react with, and impinge on these sub-systems. This requires flexibility and learning in the implementation process maximizing the intended while minimizing the unintended consequences. This provides an opportunity to apply systems thinking in evaluating the current BHOMA intervention as it will allow a system-wide evaluation of the intervention [12]. Following is the proposed causal loop diagram of possible interaction across the health system building blocks, context and the community in response to the intervention.

Central to the BHOMA intervention is quality improvement in health service delivery through mentorship of health workers and provision of basic supplies at health facility level. The QI teams and their activities are major drivers of the intervention. The aim in the short term is to improve service quality and coverage leading to improvement in impact indicator which for the BHOMA intervention is “age adjusted adult mortality rate”.

The intervention will therefore affect several health system building blocks either directly or indirectly. The affected building blocks could in turn influence other building blocks positively or negatively. In some cases both positive and negative effects could occur simultaneously.

Figure 2 illustrates the dynamic causal web in the form of a causal loop diagram. It is envisaged that improvement in the quality of services will lead to improvement in coverage through increased community demand for services. This improvement can be facilitated and mediated through single or several interactions between the building blocks. For example through mentoring, training and supervision of health workers their competences and motivation could be improved leading to good clinical care and hence community demand for services would improve.

However, the increased demand may have unintended consequences where the demand for the services exceeds the capacity of health workers to deliver the services, hence the services may remain poor despite the presence of the intervention. This will in turn result in reduced demand as shown by the negative feedback loops B1 and B2.(See figure 2)

The other elements to be improved will be information collection and use. This will firmly support good decision making, thereby supporting improvements in governance which in turn will improve human resource management, leading to motivation of health workers and community participation, transparency and improved medical supply. Improvement in supply chain management and availability of essential supplies will in turn lead to increased demand for services in the community. Feedback loop (R2) is reinforcing describing the interaction between human resource, health information and governance.

Another positive feedback loop (R1) is noted between mentorship and human resource supported through the process of learning and adaptation of the intervention, leading to improved mentorship and better acceptability of the intervention by health workers. It is important to note that several links are continuous and it is not possible to show cause or effect but rather observe and explain relationships as they occur over time. For example, better governance can lead to improvement in human resource management, but governance in turn depends on availability of trained human resources who are well supported by quality and timely information.

Financial resource management may partly depend on governance but also competent human resources who are responsive to community needs and demands.
One important thing to point out is the influence of context and how it interacts and modifies the intervention [6]. Several issues come under contextual factors some of these which could act as facilitators while others could act as barriers to health service demand. For example, rural communities often have traditional structures which support new health initiatives through headmen or chiefs. On the other hand, certain negative traditional beliefs and practices can negatively affect intervention success. This complexity warrants the application of systems thinking concepts to allow for the capture of the dynamic interaction between and across building blocks.

Subsystem evaluations from systems thinking perspective

Table 1 shows the health system building blocks and critical evaluation steps which relate to systems thinking. To illustrate how this table shall be used, we shall look at the human resource building block as an example. The overall question in the human resource building block is: Has the human resource changed and how has it changed following the intervention?

1) **The process:** Establishing baseline data and then conducting follow up studies answering the following: Are the human resource guidelines being implemented as planned? What practices are there for motivation and incentives?

2) **Context:** Failure to understand the context can lead to wrong interpretation of results. The question of attribution needs special consideration, hence the need to answer the following: What other interventions are targeting human resource in the study districts? Are there national initiatives on human resource that can negatively or positively affect the human resource in health? What is the general economic condition at present and during the study time in Zambia?

3) **Effect:** Measuring the effect is very important to show whether the intervention is working or not. Systems thinking application require looking for effects beyond just the building block in which the intervention was done. Hence under human resource we need to answer the following: What is the effect of Human resources on service delivery? What is the effect of human resource on other sub-systems including governance, health information and finance? The BHOMA intervention is targeting training and mentoring of health human resources and recruitment of community health supporters. Changes in these aspects will help to know what is happening in the human resource building block and whether the effect can be traced in other building blocks. We will use a balanced scorecard to report the effects across the building blocks.

4) **Indicators and data sources:** Choosing appropriate indicators is very important to demonstrate desired changes, either positive or negative. Evaluation of a complex intervention like the BHOMA requires both quantitative and qualitative methodologies. Selection of indicators was guided by literature, community and health worker consultations in the target districts.(See Annex 1)

Subsystem positive and negative effects: Intended and unintended consequences

Tracking changes of an intervention through the eye of systems thinking requires monitoring both positive and negative effects. In the BHOMA intervention we have summarised how we envisage the impact of the intervention would be, not only within each building block but also across the continuum of the six building blocks for health system strengthening. The example of human resources will be used again to

describe the postulated positive and negative effects of the BHOMA intervention stratified by level of health system administration.

Intervening in the human resources building block will inevitably affect other building blocks. The most obvious spillover effect will be noted in the governance, service delivery, finance and health information where health workers will be mentored on issues of good clinical practice, record keeping and good management practices. This might also lead to better supply chain management. The effect will go across all the levels of health care delivery including the district, health facility and community.

Possible direction of effects of intervening in the human resources is summarised in Table 2. It is conceivable that better recruitment practices will lead to increased number of health workers at district level with few posts remaining vacant. This will result in improved density of health workers and supervision capacity. This might have a positive effect of improving service provision. A negative effect could be that when staffs are well trained and mentored they acquire a better profile and might leave the rural health facilities for better jobs in urban areas. Improving human resource conditions may drain resources from other needy areas and these might show poor performance even when the human resource domain is doing well.

At health facility level the intervention is expected to improve the number of support staff and provide incentives and motivation for the health workers. Hence, service delivery will improve and coverage of services will be better. The possible negative effect could be unhealthy competition for incentives and training opportunities. A higher volume of service demand than available capacity might occur with health services still remaining poor.

The BHOMA intervention will therefore be monitored both for positive and negative effects. It must be noted that the list is not exhaustive but highlights the point which underpins systems thinking that some unintended consequences may occur even in well intended interventions [6,9]. These must be known and their effect minimised in order to maximise the good and intended effect [9].

Study design

The BHOMA intervention is designed as a stepped wedge randomised cluster trial. The unit of randomisation is the health facility and its catchment population. Each health facility has been randomly allocated to receive the intervention in different steps until all the 42 eligible health facilities receive the intervention. The intervention starts

in 2011 and end in 2014.The full description of the study design is presented in another paper [15].

Data collection and analysis plan

District level data collection

Data will be collected from the district health team. Respondents will include the district director of health, clinical care specialist, pharmacist and health information officer. Interviews will also be held with the quality improvement team to establish challenges in the implementation of the BHOMA invention.

Health facility surveys:

Health facility surveys will be conducted annually in all facilities. Tools for data collection have been adapted from the WHO health facility survey tools, Measure Evaluation and Health Facility Assessment Network (HFAN). Both quantitative and qualitative data will be collected during the annual surveys. Data capture will follow WHO health building blocks on health system strengthening including governance, finance, human resources, health information, medical supply and service delivery. Contextual factors will also be captured during the annual facility surveys. Attention will be paid to the interaction and dependence between the building blocks, context and the community. Both intended and unintended consequences will be recorded and reported.

***Sampling and eligibility criteria*.**

All the 42 target health facilities in the three districts will be included in the annual surveys. Hospitals and private clinics will not be included in the sampling.

Target population

At each health facility, managers and persons in-charge of health information, drugs and medical supply and financing will be interviewed. At least two non-managerial health workers will be interviewed separately to get an independent view of services being provided by the health facility. Clinical observations and exit interviews will also be conducted at each health facility. Five (5) observations and five (5) exit interview will be conducted for children and adult services separately. In addition, we will conduct a series of in-depth qualitative interviews (with facility managers and district health managers and focus group discussions (with the community) to enable us to interpret the quantitative results and explore important factors facilitating or hindering the delivery of the intervention. We will have on-going

discussion and consultation with stakeholders to share the results for learning and intervention adaptation.

Household Surveys

The full methodology of the household surveys and sample size calculations are presented elsewhere [15].In summary, household surveys will be conducted in a random sample of 120 households which fall under respective target health facilities. A household will be eligible for inclusion in the study if it has any person above 18 years of age. The households will be enumerated and a standardised questionnaire based around validated demographic and health indicators from the Demographic and Health Survey (DHS) will be used. In addition, questions will be asked about health seeking behaviour, coverage of key interventions (based on co-coverage indicators for maternal and child health) and health care expenditure. Additional questions will be asked about recent health care encounters (clinic and community), satisfaction with health care and accessibility of health services.

Reporting the effect: Balanced scorecard

Balanced scorecards have been used in healthcare monitoring and evaluation at patient, facility, district and national level but mostly in high income countries [16]. Recently WHO endorsed the balanced scorecard approach in evaluating health system strengthening interventions in low income countries [17]. One study conducted in Afghanistan used the balanced scorecard system to evaluate the performance of the health system based on selected indicators over a period of five years. In this work Edward et al, (2011) made important modifications to the traditional balanced scorecard. They included domains such as patient and community, human resources, service provision and health system preparedness indicators for equipment, essential commodities and infrastructure [18,19]. We will adopt and adapt a similar balanced scorecard approach to capture the systems wide effects across the health system building blocks. This will be complemented by qualitative data and context analysis.

Analysis Plan cycle

Steps:

1. Consesus building on the possible effect of the intervention both positive and negative
2. Developing of questions and data collection tools based on literature and consultation with local stakeholders and pre-testing the tools. Ending with a proposed conceptual framework(causal loop diagram)
3. Baseline balance scorecard evaluation to compare baseline characteristics focusing on system wide characteristics and contextual factors(quantitative and qualitative data)
4. Initial learning and validation of baseline results with stakeholders in the target districts
5. Monitor changes in response to intervention using balanced scorecard and qualitative interviews after 12 months
6. Analyse the links between the observed effect,(intended or unintended) contextual factors and possible counter intuitive results: (See Table 2 for positive and negative effects)
7. Learning and intervention adaptation: Discussion with stakeholders and intervention implementers to discuss 12 months follow up findings and possible contextual factors and exploration of the original casual loops diagrams and making adjustments based on lessons learnt
8. Sharing the new validated causal loop diagram with stakeholders and implementers for future direction and adaptation of the intervention
9. 24 months follow-up study and repeating the cycle described till the end of the study in 2014.

The basic unit of analysis will be a health facility and its catchment area. Scores will be generated for the health system building blocks using balanced scorecard approach [20,21]. Quantitative data will be exported to SPSS Version 17 for analysis. Comparison will be made at baseline and 12 months post intervention in control and intervention health facilities. Qualitative data will be analyzed using NVIVO software version 10.

Discussion

The current drive to strengthen health systems provides an opportunity to develop new strategies that will enable countries to achieve targets for millennium development goals [22,23]. The status quo of public health interventions have been criticised as too narrow and implemented in piece meal fashion, lacking comprehensiveness and whole-system perspective. This compartmentalized approach is said to be engrained in the financial structures, intervention designs and evaluation methods of most health agencies [6]. In recent time, it has been acknowledged that conventional analytical methods are generally unable to satisfactorily address situations in which population needs change over time often in response to the interventions themselves [6,24,25]. The term dynamic complexity has been used to describe such evolving situations [6].Dynamically complex problems are characterised by long delays between causes and effects and by multiple goals and interests that may in some ways conflict with one another [6]. This makes it difficult to know how, where, and when to intervene, because most interventions will have unintended consequences and will tend to be resisted or undermined by opposing interests or as a result of limited resources or capacities [6,24,26]

The commonly used frameworks for programme evaluation in health care are logic models. These provide theoretical basis for most evaluation [27]. The logic model proposed by the Kellogg Foundation is one such commonly used model [28]. The assumption underlying all logic models is that there is a logical and unidirectional linear relationship from inputs through to outcome or impact [27,28].

However, it has been recognized that relationships between elements in health care programmes are more complex with feedback loops connecting various elements of a programme. These tend to be nonlinear and often unpredictable [29,30]. Logic models which fail to capture these complexities have limitations when it comes to evaluation of complex interventions [27]. This stands in contrast to systems thinking approaches which take into account the patterns and relationships in a system reflecting both positive and negative feedback loops [27,30].

In our study we hope to apply systems thinking to address gaps in knowledge on health system strengthening in low income settings and explore contextual factors that are important in improving health system performance. The use of systems a thinking approach will ensure that we explore relationships and interconnections between health system building blocks looking at both positive and negative effects. It

is hoped that this study will facilitate adoption of similar interventions to strengthen the health system in Zambia, justifying the need for using systems wide approaches.

The study has inherent weaknesses and limitations that must be considered when evaluating the impact in the short or long term. The life time of the project is 5 years and yet systems thinking acknowledge that usually there are considerable delays between the intervention and the effects in most systems [1,4]. The five year period may be too short to assess the full impact of the intervention. It is therefore recommended to model the results at the end of the five years and to extrapolate the effect over a longer time frame. We hope that this will be done with the BHOMA intervention. There are several unprecedented activities and funding to accelerate reaching MDGs in Zambia and recently there has been a change of government. These changing contextual factors may confound the effect of the BHOMA initiative making it difficult to attribute the effect to the BHOMA intervention. Nonetheless, we hope to keep track of major changes that may affect the results of the BHOMA intervention and take them into consideration when interpreting the results.

Another limitation is related to the inherent weakness and bias in interview data and clinical observations where the responders may give desired answers rather than what is actually happening on the ground. In addition, observations of participants may change the way they practice under normal circumstances. One unique challenge with this study is that it may be viewed as inspection of the performance of managers and their teams at the health facility and they may feel uncomfortable to discuss weaknesses as this may be taken as failure on their part. On the other hand, junior staff may feel intimidated to discuss weaknesses in their work environment for fear of victimisation. Since the study will be conducted in rural districts, the results may not be generalised to other settings making it necessary to conduct similar studies in urban settings. One fact to be acknowledged is that, the current study tries to evaluate a complex health system intervention. The methodological challenges are well recognised and this study is no exception [31]. It is hoped that the use of mixed methodology and application of system wide approaches will help mitigate some of the methodological challenges and limitations.

Conclusion:

In this study, we propose to apply system thinking concepts to evaluate a complex health system intervention. We hope that lessons learnt from this process will help to adapt the intervention and limit the unintended consequences while promoting positive effects. Emphasis will be paid to the interaction and interdependence between the health system building blocks, context and the community.

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Competing interest

The authors declare that they have no competing Interest

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Table 1: Approach to evaluating the Health Systems Building Blocks: Research questions, processes, context and effect tracking within and across the building blocks							
	Governance	**Finance**	**Human Resources**	**Health information**	**Medical supplies**	**Service Delivery**	**Evaluation approaches**
Main sub-system question	Has governance changed? How has governance changed?	Has financing changed? How has it been changed?	Has human resource changed How has this changed?	Has health information changed? How has it changed?	Has medical supply changed? How has it changed?	Has service delivery changed? How has it changed?	-Baseline scores -Compare intervention and control health facilities
Processes	Are the guidelines on governance being implemented as planned How is this being done?	Are the guidelines on finance being implemented as planned? How is this being done?	Are the human resource guidelines being implemented as planned? What practices are there for motivation and incentives?	Are the guidelines and protocols on Health information being implemented as planned?	Are the guidelines on medical supply being implemented as planned? How are they connected to the National system?	Has the implementation of all the sub-systems gone according to plans? What implementation processes affected services delivery and How?	Observation, checklists, qualitative interviews with managers, health workers and service users
Contexts	What other interventions are targeting governance in the area and national level? What are some local cultural and geographical issues affecting governance	What other interventions are targeting Financing? What is the coverage? What are some local cultural and geographical issues affecting financing	What other interventions are targeting human resources in the area and nation? What is the general economic condition? What are some local cultural and geographical issues affecting human resources	What other intervention are targeting HI in the district and National level? Any specific donor driven initiatives related to HI? What are some local culture and geographical issues can affecting Health information	What other intervention aimed at MS is in place? What components of MS are affected? What are some local cultural and geographical issues can affecting Medical supply	Are there any interventions in the community or at National level that may influence service delivery? Are there other specific interventions that may affect service delivery?	Key informant interviews at district and health facility level, stakeholder analysis, Observations
Effect: **Dynamic interaction and Interdependence**	What is the effect of governance on service delivery, human resources, medical supplies and health information and what are the effect of these subsystems on governance?	What is the effect of finance on human resource, service delivery Medical supplies ,Health information ,governance and what are the effects of these subsystems on finance	What is the effect of human resource on service delivery, medical supply, Health information, governance, finance and what are the effects of these subsystems on human resource?	What is the effect of Health information on service delivery, governance, finance, medical supplies and what are the effects of these subsystems on health information	What is the effect of Medical supply on service delivery, health information, human resource , finance, governance and what are the effects of these subsystems on medical supply	What is the effect of service delivery on health information, human resource ,finance, governance, medical supply and what are the effects of these subsystems on service delivery?	Conduct both quantitative and qualitative interviews looking for interaction across and within the building blocks

Table 2: Application of system thinking approach: Intended and unintended consequences				
Main sub-system	*Positive(intended)*	*Comments*	*Negative(unintended)*	*Comments*
Service Delivery:				
	-Personalised care -Improved service quality -Motivated staff **Increased utilisation, coverage of services**		-Overwhelming demand for services -Overcrowding -Competition for incentives -Falsification of data to get benefit **Poor service quality**	
Human Resources				
	-Improved staffing levels -Improved moral and motivation among health workers **-Improved quality of service-client satisfaction with service** **-increased utilisation** **-increased coverage**		-Competition to get incentives -Low moral if incentives are low or removed -Overwhelming demand for services **Poor quality of services**	
Medical Supplies				
	-Availability of drugs and supplies at health facility -Fewer stock outs -Good stock management practice -More community confidence **-increased utilisation and coverage**		-Misuse of supplies e.g. drugs -Stealing of supplies -Sale to black markets -Expiry supplies -Stock out persist -Drug resistance -corruption **Poor quality of Service**	
Health information				
	-More health information infrastructure at Health facilities -Patient level data capture -Less use of stationery -Better record keeping -Community level data included -Good quality and reliable data -Easy to generate local reports **-Timely reporting** **-Evidence based-planning** **-Responsive services**		-Too much work for Health workers to enter data -Need data clerk all the time -Other services may be neglected -May suffer from interruption of power and internet services -May become corrupted -Mainly quantitative data -Data may be falsified to reach targets -**Poor quality data** **-Insufficient qualitative data**	
Governance				
	-Better trained health managers -Better district planning -Evidenced based planning -Motivate district and health facility workforce -Co-ordinated health Services -Better stakeholder involvement -Better retention of human resources		-Loss of trained managers to urban districts. -High turnover of staff **-Poorly trained new managers** **-Bad governance practices persist**	
Finance				
	-Availability of resources -Efficient use of resources -More accountability -Reduced corruption -Better priority setting -Cost-effective intervention promoted		-More workload to account -Corruption -Other service areas may suffer -Increased misuse of available resources **Corrupt practices persist**	

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Annex 1: Summary of indicators for the Evaluation of the WHO six building blocks for health system strengthening

Service delivery Domain	Indicators		Data source	Questionnaire
	Coverage	***Quality***		
	% Suspected TB correctly screened	% TB cure rate	HF survey	Health facility audit
Adult Health Services (AHS)	% Eligible HIV Positive on ART	% Retention rate	HF survey	Health facility audit
	% Hypertensive patients on medication	% Visited clinic HF last 12 for Check ups	HH survey	Community survey
		% Service satisfaction	HF survey	Exit interviews
Average score (AHS)				
Child Health Services (CHS)	% Slept under bed net last night	% Slept under treated bed net	HF survey HH survey	Community survey
	% Diarrhea last 2 weeks given ORS	% Diarrhea correctly treated	HF survey	Community survey and clinical observations
	% Suspected Pneumonia referred to HF	% Suspected pneumonia correctly treated	HF survey	Community survey and clinical observations
	% Infants HIV exposed screened at 6 weeks (PCR)	% HIV exposed screened at 12	HF survey	Health facility audit
		% Service satisfaction	HF survey	Exit interviews
Average score(CHS)				
Antenatal Services (ANC)	% Pregnant women tested for HIV and received results	% HIV positive pregnant women who received PMTCT package	HF survey	Facility audit
	% live birth attended by skilled HW	% of women seen within one week by HW/CHW after delivery	HH survey	Community survey
Average score (ANC)				
Mean Score (All Services)				
Overall health system	% HIV controlled in the community	% patients on ART with viral suppression at 6 months?	HF survey HH survey	Community survey

Human Resources:	***Indicator***		**Data source**	**Questionnaire**
	Coverage	***Quality***		
	% Receiving Training last 12	% Receiving supervision last 12 months	HF survey	Health worker questionnaire
	Density of health workers per 1000 population	% Present on the actual day of survey	HF survey	Health facility audit
	Motivation Score (23 items)	FGD with HW on motivation	HF survey	Health worker questionnaire and FGD with HWs
Medical Supplies	*Adapted from the International Health Facility Assessment Network (IHFAN) report ,2009*			

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	Infrastructure score (11 items)	Verification by inspection	HF survey	Health facility audit
	Pharmaceutical Score 17 (items)	Verification by inspection	HF survey	Health facility audit
	Equipment /Diagnostics Score (16 items)	Verification by inspection	HF survey	Health facility audit
	Infection Control Score (9 items)	Verification by inspection	HF survey	Health facility audit
Total Medical supplies Score	**Total Score out of 53**			

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Governance sub-system				
Governance	**Elements**	**Indicators**		**Questionnaire**
Health facility level	**Vision** Shares in the vision of the MoH through strategic plan	Availability of protocols for adult, child and maternal health from MoH		Key informants and Governance questionnaire
	Intelligence and oversight -Generation, analysis and use of data -Sharing of information	-Evidence of generation and use of data (inspection) -Part of the governance Score		Governance and Health information questionnaires
	Regulation and management capacity(fair rules of the game) -Accountability -Transparence -Community participation	Availability of mechanisms for accountability, transparence and community participation -Part of Governance Score		Key informant ,FGDs and Governance questionnaires
Overall Governance Score:				
Financing	Availability of budgets and finance guidelines	Verification by inspection	HF survey	Finance questionnaire and Key informantinterviews
	At least one person in-charge of financing(fulltime or part)	% Trained in finance management last 12 months	HF survey	Finance questionnaire and Key informantinterviews
	% of last budget actually received	Timeliness of fund disbursement	HF survey	Finance questionnaire and Key informantinterviews
	Health Expenditure per Capita		HF survey	Finance questionnaire

CHAPTER 4:

4. MEASURING HEALTH WORKER MOTIVATION:

4.2. Research Paper 2:

For research paper already published:

Tile: Measuring health workers' Motivation in rural health facilities: Baseline results from the three study districts in Zambia

Where was the work published: **Journal of human resources for Health**

When was the work published: **February, 2013**

If the work was published prior to registration for your research degree, give a brief justification for its inclusion: **None applicable**

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For multi-authored work give full description of your role in the research and preparation of the paper:

I was a lead researcher on health system evaluation on the BHOMA project. Designed the study tools and took part in data collection. Performed all the data analysis and drafted the manuscript and was the lead author.

Candidate Signature:

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Supervisor or senior author's signature to confirm roles as stated:

_____

HUMAN RESOURCES FOR HEALTH

RESEARCH Open Access

Measuring health workers' motivation in rural health facilities: baseline results from three study districts in Zambia

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Abstract

Introduction: Health worker motivation can potentially affect the provision of health services. Low morale among the workforce can undermine the quality of service provision and drive workers away from the profession. While the presence of high-quality, motivated staff is a key aspect of health system performance, it is also one of the most difficult factors to measure.

Methods: We assessed health worker motivation as part of the baseline assessment for a health system strengthening intervention in three rural districts in Zambia. The intervention (Better Health Outcomes Through Mentoring and Assessment (BHOMA)) aims to increase health worker motivation through training, mentoring and support. We assessed motivation by examining underlying issues grouped around relevant outcome constructs such as job satisfaction, general motivation, burnout, organization commitment, conscientiousness and timeliness that collectively measure overall levels of motivation. The tools and the concepts have been used in high-income countries and they were recently applied in African settings to measure health worker motivation.

Results: Female participants had the highest motivation scores (female: mean 78.5 (SD 7.8) vs male: mean (SD 7.0)). By type of worker, nurses had the highest scores while environmental health technicians had the lowest score (77.4 (SD 7.8 vs 73.2 (SD 9.3)). Health workers who had been in post longer also had higher scores (>7 months). Health workers who had received some form of training in the preceding 12 months were more likely to have a higher score; this was also true for those older than 40 years when compared to those less than 40 years of age. The highest score values were noted in conscientiousness and timeliness, with all districts scoring above 80.

Conclusions: This study evaluated motivation among rural health workers using a simple adapted tool to measure the concept of motivation. Results showed variation in motivation score by sex, type of health worker, training and time in post. Further research is needed to establish why these health worker attributes were associated with motivation and whether health system interventions targeting health workers, such as the current intervention, could influence health worker motivation.

Introduction

Health worker motivation has the potential to affect the quality of health services. It has been recognized that low health worker morale can severely undermine de- mand for health services and may lead to wastage or loss of the limited number of workers [1,2]. In its 2006 World Health Report *Working Together for Health*, the World Health Organization (WHO) indicated a dramatic shift from understanding poor health worker perform- ance as being caused by lack of knowledge and skills to a focus on health workers' motivation and on manage- ment of the workforce [3,4]. The report emphasized the need to develop capable, motivated and supported health workers. This is an essential ingredient in overcoming bottlenecks to achieving national and global health goals [3,4]. In recent years there has been an upsurge of inter- est in human resources required to deliver healthcare in low-income settings in an effort to achieve targets for

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Table 1 Mean scores for the 23-item motivation construct

Category	Description	Mean score (1 to 5)
General motivation	Feel motivated to work hard	2.97
	Only do this job to get paid	3.95
	I do this job as it provides long-term security for me	2.99
Burnout	I feel emotionally drained at the end of the day	3.02
	Sometimes when I get up in the morning, I dread having to face another day at work	3.46
Job satisfaction	Overall, I am very satisfied with my job	3.71
	I am not satisfied with my colleagues in my work	3.74
	I am satisfied with my supervisor	3.92
Intrinsic job satisfaction	I am satisfied with the opportunity to use my abilities in this job	4.00
	I am satisfied that I accomplish something worthwhile in this job	4.17
	I do not think that my work in this health facility is valuable these days	3.95
Organization commitment	I am proud to be working for this health facility	4.02
	I find that my values and this health facility are very similar	3.60
	I am glad that I work for this facility rather than other facilities in the country	3.05
	I feel very little commitment to this health facility	3.98
	This health facility really inspires me to do my very best on the job	3.52
Conscientiousness	I cannot be relied on by my colleagues at work	4.34
	I always complete my tasks efficiently and correctly	4.08
	I am a hard worker	4.59
	Do things that need doing without being asked or told	4.44
Timeliness	I am punctual about coming to work	3.98
	I am often absent form work	4.58
	It is not a problem if I sometimes come late for work	4.09

The scale for negatively worded questions was reverse coded so that 1 was 'strongly agree' and 5 'strongly disagree'. Thus, a high score shows disagreement with a negative statement and is therefore suggestive of higher motivation.

the UN Millennium Development Goals [5]. Much of the attention has been on the inadequate numbers of healthcare workers and their inequitable distribution [4-9]. However, it is increasingly appreciated that atten- tion must also be paid to health worker performance and motivation [10-12].

Although it has been accepted that the presence of high-quality and motivated staff is essential for provision of quality healthcare, at the same time it has also been acknowledged that this is one of the most difficult inputs to assess and ensure [11]. Health worker job satisfaction, which can be defined as 'the attitude towards one's work and the related emotions, beliefs, and behaviors', results from complex interactions between on-the-job experience, organizational environment and motivation [13]. Motivation is defined as an individual's degree of willingness to exert and maintain an effort towards attaining organizational goals [13]. Job satisfaction is inextricably linked to motivation and both involve cognitive, affective, and behavioral processes, with worker motivation commonly understood as the reason why workers behave as they do towards achieving personal and organizational goals. Neither job satisfaction nor motivation is directly observable, but both have been identified as critical to the retention and performance of health workers [12,13].

Many factors that range from available physical infrastructure to an individual's highly personal values are known to influence the performance of health professionals [11,14]. It is likely that motivation influences performance directly and mediates or modifies the effect of interventions aimed at changing performance; however, there are few studies on its influence on practice change in health workers in low-income settings [11,14]. The existing studies have focused predominantly on determinants of motivation, with less of the literature focusing on conceptualizing and measuring worker motivation.

Some authors have contended that the main determinant of health sector performance is health worker motivation, and while resource availability and worker competence are necessary, they are not sufficient [14]. In addition to technical training, health workers must work in environments with incentives in place that reward high-quality performance. To this end, an understanding

Table 2 Demographic characteristics of the health workers recruited in the motivation evaluation

Variable	n	%
District:		
Chongwe	54	56.3
Kafue	29	30.2
Luangwa	13	13.5
Sex:		
Male	41	42.7
Female	55	57.3
Age group:		
20 to 29	25	26.0
30 to 39	29	30.2
40 to 49	18	18.8
≥50	24	25.0
Role:		
Nurse	36	37.5
Clinical officer	18	18.8
Environmental health technician	16	16.7
Classified daily employee	11	11.5
Other workers	15	15.6
Time in post:		
3 months	6	6.3
4 to 6 months	1	1.0
7 to 12 months	14	14.6
More than 12 months	75	78.1
Received training past 12 Months		
No	30	31.3
Yes	66	68.8

of employee motivation is necessary to design systems with the right incentives [15].

In Zambia, a study performed in the context of HIV services in urban health facilities within the public sector showed that 50% of health workers met the definition of being in burnout and many health workers complained of poor pay, stress and work overload. Most of them confirmed that they were prone to leaving the current post in search of greener pastures in non-governmental organizations (NGOs) and the private sector [16].

Within the Zambian government system, there are 9 Provincial Health Offices, 72 District Health Offices, 98 hospitals, 265 urban health centers, 1,029 rural health centers, and 171 health posts. Health centers are intended to serve 30,000 to 50,000 people in urban areas and 10,000 people in rural areas, with a 29-km radius catchment area. Human resource challenges for the health sector in Zambia are well documented [17]. Shortage of skilled health workers constitutes a very important bottleneck to service delivery. According to records from the Ministry of Health (MOH), the total number of staff in the health sector stands at 29,533, which is 57 percent of the approved establishment. Less than 50% of frontline health workers (nurses, midwives, clinical officers, environmental health technicians (EHTs)) are available in relation to need to provide primary healthcare [18].

Public facilities in rural and remote areas have the lowest number of health workers compared to urban areas [18]. The result is that there are a number of Health Posts and Rural Health Centers in rural and re- mote areas that are run by unqualified staff or have only one qualified staff member [17,18].

In this study we adopted a 23-item score to measure health workers motivation as part of the baseline for a health-system-strengthening intervention in 3 rural districts of Zambia. Our aim was to determine the applicability of the motivation tool in the Zambian healthcare context, especially among rural health workers in rural health facilities, with a view to using the tool in subsequent monitoring of change in motivation after the implementation of health system interventions described elsewhere (Mutale *et al.*, unpublished, [19]. The tool used and the underlying theoretical concepts have been used in high-income countries [13,20,21] and have re- cently been adapted and used in Kenya among hospital health workers [22]. However, this tool has not been applied in small rural heath facilities where motivation determinants may be different from those working in hospitals.

Methods

This work is part of a larger study in Zambia known as Better Health Outcomes through Mentoring and Assessment (BHOMA), which is a stepped wedge community randomised controlled trial that aims to strengthen the health system in three rural districts of Zambia. The BHOMA intervention is being implemented in Chongwe, Luangwa and Kafue Districts, all in Lusaka Province, Zambia. The combined population for the 3 districts is 306,000, with a total of 48 health facilities and 4 general hospitals. Two separate but complementary packages are being applied in the BHOMA intervention: the health facility package (which targets the health workers and their support staff through training, mentoring and support) and the community-based package (which works within the community to improve access to health services and improve data and referral systems).

The BHOMA intervention is complex and labor intensive, and is therefore being rolled out gradually from one health facility to the next over a period of 3 years using a stepped wedged design [23,24]. The full intervention and the evaluation design are described elsewhere (Mutale *et al.*, unpublished [19]. A baseline health facil- ity survey was conducted in 42 out 48 health facilities

Table 3 Overall motivation scores stratified by demographic characteristics

Variable	N	Overall mean score	SD
District:			
Chongwe	54	88.76	8.87
Kafue	29	85.97	9.57
Luangwa	23	90.54	7.47
Residence:			
Peri-urban	20	86.70	8.55
Rural	70	88.61	9.39
Hospital	6	87.67	4.76
Sex:			
Male	41	74.10	7.04
Female	55	78.56	7.85
Role:			
Nurse	36	77.44	7.82
Clinical officer	18	74.78	6.36
Environmental health technician	16	73.15	9.31
Classified daily employee	11	76.99	6.97
Other workers	15	80.52	6.86
Time in post:			
3 months	6	74.78	13.46
4 to 6 months	1	70.43	0.00
7 to 12 months	14	75.90	7.37
More than 12 months	75	77.03	7.43
Received training past 12 Months			
Yes	66	77.59	7.15
No	30	74.61	8.85
Age group:			
20 to 29	25	75.79	9.43
30 to 39	29	74.15	7.38
40 to 49	18	78.84	6.38
≥50	24	78.95	6.65

found in the 3 BHOMA districts between January and April 2011. This constituted 96% of the total health facilities, with the rest being used as pilot sites for the BHOMA intervention.

In this study, we interviewed 1 to 3 health workers at each of the 42 health facilities who were present at the time of baseline data collection, depending on the available staff. Most health facilities had just one eligible health worker. Where there were more than three, up to three health workers were randomly selected to take part in the study. They were eligible if they had been working in the facility for at least 1 month and were attending to patients. All participants were given instructions about the tool, which was self-administered though the respon- dents were free to clarify questions that they did not understand. Before being used in the Zambian setting, the tool was pretested and questions were adapted to suit the lower level health facilities but the content remained essentially the same as described by Mbindyo *et al*. [22].

The data collection tool was selected as it was easy to use and there is no available tool that has been used in Zambia previously. It is hoped that the assessment will be repeated after 12 months in the same health facilities to determine any changes. The tool had 23 items, with answers given on a scale of 1 to 5 (strongly agree to strongly disagree) (Table 1). The items with negative statements were reverse coded when calculating scores.

Data was entered into a Microsoft access database (Microsoft, Redmond, WA, USA) and exported to SPSS version 19 (SPSS, Chicago, IL, USA) for analysis. Factor analysis was used to confirm latent factors described by Mbindyo *et al*. [22]. The scores were standardized to 100 in order to allow for comparison between subscores. The overall scores were calculated by the sum of all subscores of the latent factors described. Linear regres- sion was used to identify determinants of motivation.

Ethical considerations

The study was approved by the University of Zambia Bioethics Committee and the London School of Hygiene and Tropical Medicine Ethics Committee. All respondents

Table 4 Mean standardized motivation subscores by latent factors stratified by district and gender

Category	Chongwe (n = 54)		Kafue (n = 29)		Luangwa (n = 13)	
	Male (n = 22)	Female (n = 32)	Male (n = 14)	Female (n = 15)	Male (n = 5)	Female (n = 8)
General motivation	63.94	66.66	63.81	70.22	52.00	74.17
Burnout	63.64	67.19	62.14	64.00	68.00	62.50
Job satisfaction	75.45	79.17	70.48	71.56	72.00	82.50
Intrinsic job satisfaction	78.48	82.29	74.76	82.67	85.33	85.00
Organization commitment	66.73	79.12	64.86	73.87	72.80	75.00
Contentiousness	85.00	88.59	86.43	86.67	96.00	85.63
Timeliness	86.36	82.91	80.95	84.44	88.00	88.33

Table 5 Factor analysis of health worker motivation

No.	Description	General motivation	Burnout	Job satisfaction	Intrinsic job satisfaction	Organization commitment	Contentiousness	Timeliness
1	I Feel motivated to work hard	0.563						
2	I Only do this job to get paid	0.623						
3	I do this job as it provides long-term security for me	0.719						
4	I feel emotionally drained at the end of the every day		−0.789					
5	Sometimes when I get up in the morning, I dread having to face another day at work		0.540					
6	Overall, I am very satisfied with my job			0.721				
7	I am not satisfied with my colleagues in my work			-				
8	I am satisfied with my supervisor				0.790			
9	I am satisfied with the opportunity to use my abilities in this job				0.678			
10	I am satisfied that I accomplish something worthwhile in this job				0.569			
11	I do not think that my work in this health facility is valuable these days				0.697			
12	I am proud to be working for this health facility					0.717		
13	I find that my values and this health facility are very similar					0.718		
14	I am glad that I work for this facility rather than other facilities					0.633		
15	I feel very little commitment to this health facility					0.601		
16	This health facility really inspires me to do my very best on the job					0.626		
17	I cannot be relied on by my colleagues at work						0.649	
18	I always complete my tasks efficiently and correctly						-	
19	I am a hard worker						0.727	
20	Do things that need doing without being asked or told						0.715	
21	I am punctual about coming to work							0.824
22	I am often absent from work							0.776
23	It is not a problem if I sometimes come late for work							0.838

Extraction method was principal component analysis. Rotation method was varimax with Kaiser normalization.

were informed about the purpose of the survey and were asked to sign a consent form before taking part in the study. Confidentiality was ensured during data collection and subsequent publication of the results.

Results

In total, 96 health workers completed the self-assessment tool and none of the health eligible health workers refused to participate, giving a 100% response rate. Most of the participants were from Chongwe district, a reflection of the number of health facilities in that district compared to

the other two districts. Luangwa had the lowest number of participants (13 (13.5%)) as it had fewer health facilities. In terms of sex distribution, there were more female respondents (41/96 (58%)) compared to males (42%). The majority of the health workers were between 30 to 40 years of age (29/96 (30%)). The skill mix included nurses who were twice as numerous as clinical officers (38/96 (38%) versus 18/96 (18%), respectively). Untrained workers who nonetheless attended to patients (classified daily employees) made up 11/96 (12%). The majority of the respondents had been in post for more than 12 months. A

Table 6 Linear regression model for the predicators of health worker motivation score (N = 96)

Predictor	n	Coefficient	SE	*P* value
Constant		73.199	4.87	0.000
Time in post:				
Less than 6 months	7	-		
7 to 12 months	14	−3.004	4.34	0.491
More than 12 months	75	−0.798	3.60	0.825
District:				
Kafue	54	-		
Chongwe	29	1.459	2.11	0.491
Luangwa	23	4.095	3.01	0.178
Residence:				
Peri-urban	20	-		
Rural	70	3.171	2.40	0.192
Hospital*	6	−0.681	4.44	0.878
Received training?				
No	30	-		
Yes	66	2.896	2.09	0.170
Sex:				
Male	41			
Female	55	5.778	2.12	0.008
Type of health worker:				
Environmental health technician	36	-		
Nurse	18	0.341	2.97	0.909
Clinical officer	16	3.445	3.11	0.271
Classified daily employee	11	1.156	3.49	0.741
Non-clinical	15	6.909	3.29	0.039
Age	96	0.133	0.086	0.127

Overall P = 0.036, R^2 = 0.236.

third of the respondents (30/96 (31%)) reported never having attended any training in the preceding 12 months (Table 2).

The 23 items as an index of motivation had a Cronbach's α of 0.73. The highest scores were for item 19 (being a hard worker) and disagreement with the statement of being absent from work (item 22) (Table 1).

Female participants had the highest motivation scores (female mean 78.5 (SD 7.8) vs male mean 74.1 (SD 7.0)) By role, nurses had the highest scores while EHTs had the lowest mean score (nurses 77.4 (SD 7.8) vs EHT 73.2 (SD 9.3)).

Those who had received some form of training in the preceding 12 months were more likely to have a higher motivation score. This was true for those older than 40 - years when compared to those less than 40 years of age (Table 3).

Generally, female participants had the highest scores across all subcategories of motivation latent factors except for timeliness, which showed a mixed picture. The highest scores were noted for conscientiousness and timeliness, with all districts scoring above 80%. The lowest scores were for burnout, all below 70. Females in Luangwa and Kafue scored fairly highly in most categories. When comparisons were made among male participants, Luangwa had the highest scores across six of the seven categories. This was followed by Chongwe district (Table 4).

In all, 21 items had a coefficient value of more than 0.4, which was used as a cut off point for further analysis. This cut-off means that each item has a shared variance of at least 16% with the factor under consideration [25]. Using these criteria, seven latent factors were confirmed from factor analysis. The highest loading was for the timeliness latent factor. Intrinsic job satisfaction and organization commitment and general motivation factors also loaded highly on the factor analysis. Two items loaded less that 0.4, and this is shown by dashes in Table 5.

The linear regression model revealed that the major determinants of higher motivation were female gender (coefficient: 5.8, $P = 0.008$) and working in non-clinical areas (for example, pharmacists or laboratory technicians, coefficient: 6.9, $P = 0.039$). Univariate analysis showed that age and belonging to a hospital-based health facility were associated with higher motivation scores, but these were not statistically significant in the full model (Table 6).

Discussion

Motivation of health workers is key to providing good quality and accessible healthcare and achieving UN Millennium Development Goals, especially in rural communities where most of the indicators are lagging behind [18]. The results of this study could be useful, especially in the Zambian context where healthcare human resource challenges continue to hamper provision of quality services [18]. Our study has demonstrated that it is feasible to measure motivation among health workers working in very deprived and rural communities in Zambia using a simple adapted tool. It was important to validate the tool in the local context especially as it has never been used in Zambia to measure motivation among health workers. Our results also indicate that the tool could be made even simpler, as suggested by Mbindyo *et al*., from 23 items to about 10 to 12 items based on item loadings on factor analysis [22]. Our experience with the tool was that it was easy to use and most health workers did not have problems answering the questions. However, we noted that there was a tendency towards preference for higher scores, hence affecting the mean scores which were generally on the higher side with overall and subscores all above 60. This could be attributed to response bias, where the respondents tended to give higher rates as they felt this was desired [22,26].

The overall motivation patterns showed interesting variations that will be further explored when comparing the intervention and control health facilities during follow-up studies. The baseline results showed that mean motivation scores varied by sex, type of health worker, training and district. Time in post and age also showed variation in motivation scores. Further studies are required to establish why these attributes were important in explaining health worker motivation.

In terms of sex variation, motivation scores for females tended to be higher than that of male participants. Regression analysis showed significant association between motivation and female gender. Similar results have been reported in Ethiopia, where female health workers were more likely to report work satisfaction compared to males [27]. However, it is possible to speculate in terms of what motivates different genders in general. It has been recognized that men are more motivated by higher wages and prestigious jobs while women are more concerned with job security and community value for the work they do [28]. The rural environment and the poor working conditions in the health sector in Zambia seemed to have less effect on women compared to men.

Among the health workers, nurses were highly motivated when compared to clinical officers and environmental health technicians. This could be attributed to the higher number of women among nurses and the higher number of men among the less motivated groups of clinical officers and environmental health technicians. Interestingly, untrained health workers attending to patients, known as classified daily employees (CDEs), appeared to be more motivated when compared to clinical officers and environmental health technicians. This could be attributed to the fact that the CDEs may have less expectation and have other things on which they based their motivation, including appreciation by the community. More research is need to establish why CDEs appeared more motivated and whether such motivation is sustainable especially at a time when task shifting and use of lay community workers is being advocated [29-31].

The finding that non-clinical health workers (such as pharmacists and environmental health technicians) had significantly higher motivation scores agrees with the Kenyan motivation study where they also noted higher motivation among non-clinical health workers [22]. This could be related to workload, which is usually more for clinician workers and could negatively affect their motivation [32,33].

Another observation was that the longer the heath workers stayed in post the more motivated they were. This was also true for age, where older health workers had higher motivation scores than younger ones [28]. It appeared that those who had stayed longer had settled and integrated well within their community, while newcomers were faced with the challenges of working and settling in rural settings after completing training in urban training schools. This finding is crucial when discussing health worker retention schemes. The focus might be to ensure retention and reduce turnover, which is associated with many newcomers and fewer staff staying longer and hence missing out on the stability and motivation that is associated with a longer stay and age maturity [34].

One other critical finding was that those who had attended some form of training in the preceding 12 - months were more likely to have higher scores when compared to those who had never attended any training. Literature has shown that in-service training could be a motivating factor for health workers rather than just a focus on higher wages. This study seems to support the need for continuous but systematic refresher training as a source of both skills and motivation [35,36]. It will be interesting to establish whether motivation scores change with the training and mentoring intervention targeting health workers in the BHOMA trial. This will be the next stage of our ongoing work.

The limitations of our study include that it does not link motivation to service delivery in order to establish any possible causal link. This was not within the scope of the current paper. Another limitation was that we used subjective methodology to collect data from health workers and it was possible that respondents could have been tempted to give high scores, thus biasing the results. It must also be noted that motivation was measured among only 96 health workers. It is recommended to repeat the study with a larger sample size.

Conclusions

This study evaluated motivation levels among rural health workers using a simple adapted tool to measure the concept of motivation. The results showed variation in motivation score by gender, type of health worker, training and time in post. Further research is needed to establish why these health worker attributes were associated with motivation and whether health system interventions such as the current BHOMA initiative, can influence health worker motivation in the short or long term.

Competing interests

The authors declare they have no competing interests.

Authors' contributions

WM: conceived the paper, analyzed the data and wrote the initial draft. HA: conceived the project and reviewed the draft and final manuscript. GB: provided critical analysis and contributed to the writing of the paper. MTM: contributed to writing of the paper and provided materials for the evaluation design. DB: involved in the draft of the paper and provided critical analysis of the scientific content. All authors read and approved the final manuscript.

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CHAPTER 5:

5. MEASURING GOVERNANCE IN HEALTH SYSTEMS:

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I was a lead researcher on health system evaluation on the BHOMA project. Designed the study tools and took part in data collection. Performed all the data analysis and drafted the manuscript and was the lead author.

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_____

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RESEARCH ARTICLE Open Access

Measuring governance at health facility level: developing and validation of simple governance tool in Zambia

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Abstract

Background: Governance has been cited as a key determinant of economic growth, social advancement and overall development. Achievement of millennium development goals is partly dependant on governance practices. In 2007, Health Systems 20/20 conducted an Internet-based survey on the practice of good governance. The survey posed a set of good practices related to health governance and asked respondents to indicate whether their experience confirmed or disconfirmed those practices. We applied the 17 governance statements in rural health facilities of Zambia. The aim was to establish whether the statements were reliable and valid for assessing governance practices at primary care level.

Methods: Both quantitative and qualitative methods were used. We first applied the governance statements developed by the health system 20/20 and then conducted focus group discussion and In-depth interviews to explore some elements of governance including accountability and community participation. The target respondents were the health facility management team and community members. The sample size include 42 health facilities. Data was analyzed using SPSS version 17 and Nvivo version 9.

Results: The 95% one-sided confidence interval for Cronbach's alpha was between 0.69 and 0.74 for the 16 items. The mean score for most of the items was above 3. Factor analysis yielded five principle components: Transparency, community participation, Intelligence & vision, Accountability and Regulation & oversight. Most of the items (6) clustered around the transparency latent factor. Chongwe district performed poorly in overall mean governance score and across the five domains of governance. The overall scores in Chongwe ranged between 51 and 94% with the mean of 80%. Kafue and Luangwa districts had similar overall mean governance scores (88%). Community participation was generally low. Generally, it was noted that community members lacked capacity to hold health workers accountable for drugs and medical supplies.

Conclusions: The study successfully validated and applied the new tool for evaluating health system governance at health facility level. The results have shown that it is feasible to measure governance practices at health facility level and that the adapted tool is fairly reliable with the 95% one-sided confidence interval for Cronbach's alpha laying between 0.69 and 0.74 for the 16 items. Caution should be taken when interpreting overall scores as they tended to mask domain specific variations.

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Background

The word "Governance" is difficult to define. It's use may be associated with a set of principles, the exercise of legitimate authority through law and regulation, or processes for ensuring accountability and managing risk within organizations [1,2]. There are complex relationships within and across local, national and global levels of governance [2]. Governance has dimensions which must be consid- ered when evaluating governance practices. The three dimensions commonly cited are political, economical and institutional. The political dimension refers to the process by which governments are selected, monitored and replaced. The economical dimension refers to the capacity of the government to effectively formulate and implement sound policies, including management of public resources. The institutional dimension includes the respect of citizens and the institutions that govern economic and social interactions among them [3].

Governance has been defined by the United Nations Development Programme (UNDP) as the exercise of political, economic and administrative authority in the management of a country's affairs at all levels. Brinkerhoff et al., defined governance as the rules that distribute roles and responsibility among societal actors and that shape the interaction among them [4]. The United Kingdom Department for International Development (DFID) defined governance in terms of institutions, rules and systems of the state. The World Bank has taken the economical view of governance defining it as economic policy making and implementation with a focus on accountability and use of public resources [5]. Governance goes beyond government to include relationships and networks at various levels. It must be acknowledged that the concept of governance is not a coherent or agreed theoretical concept and there are debates about the nature of governance

Governance has been cited as a key determinant of economic growth, social advancement and overall development [6]. Research has shown that the modes of governance may influence health outcomes through their association with patterns of incentives and with regulatory and performance management regimes [7]. The achievement of millennium development goals is partly dependant on governance practices in low and middle income countries [6].

Health system governance concerns the actions and the means adopted by a society to organise itself in the promotion and protection of the health of the population. The rules defining such organization and its functioning, can be formal or informal [8].

Health systems contain three categories of actors: government, providers, and beneficiaries/clients. Health governance involves the rules that determine the roles and responsibilities of each of these categories of actors, and the relationships, structures, and procedures that connect them. Good governance in health reflects the application of a set of normative principles: accountability to patients and the broader public, an open policy process where competing interest groups operate on a level playing field, state capacity and legitimacy to manage the policy process and implement health policy decisions, effective and responsive service delivery, and the participation of civil society and private sector actors in both policymaking and service delivery [9].

In its health system building blocks which include service delivery, human resources, health information, Medical supplies, finance and governance, WHO has emphasised governance or stewardship as crucial in health system strengthening. WHO acknowledges that governance is one of the most complex building blocks. It involves overseeing and guiding the whole health system, private as well as public, in order to protect the public interest. This requires both political and technical action, because it involves reconciling competing demands for limited resources. With increasing demands for transparency and accountability the role of health system governance has become even more important [10].

Good governance should, in theory, lead to better performance. More accountability to beneficiaries can be an incentive for health officials and providers to improve services [11,12].

Thus to achieve a system of good health governance, a number of areas need to be addressed. These include improving the policy process through ensuring policymaking based on evidence and open, informed, fair and equitable involvement of key stakeholders. Community participation has to be enhanced through increasing local information and leadership, and institutional incen- tives and openness of officials. Corruption has to be re- duced, through tracking financial flows and disseminating information, auditing and citizen oversight [13].

Saddiqi et al., proposed 10 principles for assessing governance of the health system. These were strategic vision, participation and consensus orientation, rule of law, transparency, responsiveness, equity and inclusiveness, effectiveness and efficiency, accountability, intelligence and information and ethics [6].

In 2007, Health Systems 20/20 conducted an Internet-based survey on the practice of good governance in the health sector in collaboration with the Health Systems Action Network (HSAN). The survey posed a set of good practices related to health governance and asked respondents to indicate whether their experience confirmed or disconfirmed those practices. 17 questions were subsequently distilled from the semi structured and qualitative questions that represented statements about good health system governance. The responders were mainly mid level managers and the focus was at national level rather than primary care [9]. These questions were

also used to assess governance practices in Rwanda as part of health system strengthening intervention [14]. However, these statements have not been validated for regular use in evaluating health system governance especially in rural settings were the concepts of governance may be less clear. We applied the 17 governance statements and adapted the statements to fit the primary care health workers working in rural health facilities of Zambia. The aim was to establish whether the state- ments were valid for assessing governance practices at primary care level and to identify the latent factors or domains of governance that were captured in the 17 statements or items. This was done as part of the base- line study.

Methods

This work is part of larger study in Zambia known as Better Health through Mentoring and Assessment (BHOMA) which is a randomised step wedged community intervention that aims to strengthen the health system in three rural districts of Zambia. There are 42 target health facilities in the three study. The full methodology of the main study is described elsewhere [15] (*Personal communication*). In this study we used the governance tool developed by the health system 20/20 for measuring health system governance in the 42 health facilities. It contains 17 semi structured statements about good governance practices [9,14]. The answers were graded between 1 and 4 (4 = Agree 3 = Some what agree 2 = Some what disagree 1 = Disagree).The target respondents were the health facility management team in the rural health centres of Zambia. These were mainly the health facility incharge, clinical officers, nurses, environmental health technicians, pharmacists and in some places Classified Daily Employees (CDEs) who are usually lay workers working at health facility either voluntarily or are on government payroll. After explaining the self administered tool to the team they were then allowed to sit on their own and read each statement and then graded the performance of the health facility on each statement. They were only to come up with consensus responses on each statement. The teams consisted of 2-10 members with an average of 3 members per health facility. The research team did not take part in the grading and did not sit in the room where the grading was being done. The tool was pre-tested in pilot facilities which had settings similar to the study sites.

Principal factor analysis with Varimax and Kaiser Normalisation was used to determine the latent governance factors captured in the 17 statements. After factor analysis 16 statements had a coefficient above 0.4 and thus were retained for further analysis. Reliability test for the 16 items was done using cronbach's alpha.

The maximum possible score by each health facility was 64.These scores were converted to percentage for easy comparisons. The total district score was calculated by the sum of individual health facility scores. After identification of the latent factors these were analyzed separately as domains which made the overall governance score.

Ethical approval was obtained from University of Zambia Biomedical Research Ethics Committee and London school of Hygiene and Tropical Medicine.

All participants signed written consent before taking part in the study. Confidentiality was maintained during data collection and publication.

Qualitative data

For the qualitative component of the study, nine health facilities were selected from the three districts. The selection criterion was that in each district one rural, one semi-rural and one urban health facility was to be included. At each facility, In-depth interviews (IDI) were conducted with the health centre in-charge, Chairman of the Neighbourhood health committee (NHC) and a pharmacist were interviewed. Around the catchment area of each health facility, two Focus Group Discussions (FGDs) were held with men and women. In total 30 IDIs and 18 FGDs were conducted.

Qualitative data was analyzed using Nvivo version 9. The full methodology and results of the qualitative study are reported elsewhere [15]. Here we report on two elements of governance: Community participation and Accountability for medical supplies.

Results

Descriptive

Reliability of the 16 item scale

The 95% one-sided confidence interval for Cronbach's alpha for the 16 item scale for governance was between 0.69 and 0.74.

The mean score for most of the items was above 3. The lowest mean was 2.48 which referred to "There being a mechanism for correcting those not complying with standards and code of conduct "followed by the mean of 2.86 for the "health facility having protocols for adult, child and maternal health services from the MoH (Table 1).

Factor analysis

Five latent factors were identified from factor analysis. Six (6) items loaded on the transparency latent factor, two (2) items loaded on the regulation & Oversight latent factor, three (3) items loaded on community participation. Three (3) items loaded on the intelligence & vision while two items loaded on accountability latent factor.

Table 1 Showing the mean scores across the 16 items for governance

	N	*Min*	*Max*	*Mean*	*Std.*
Systems exist for reporting, investigating, and adjudicating misallocation or misuse of resources.	42	1	4	3.19	1.131
The public have regular opportunities to meet with managers of the health facility to raise issues about service efficiency or quality.	42	1	4	3.60	.828
Local organisations and health service users have influence on what services are offered at the health facility.	42	1	4	3.31	.950
There are forums and procedures that give the public, technical experts, and local communities' opportunities to provide input.	42	3	4	3.71	.457
The health facility use evidence on program results, patient satisfaction, and other health-related information to improve the services they deliver.	42	1	4	3.33	.979
Health facility managers rely on research data from health facility to plan services.	42	3	4	3.86	.354
The health facility regularly organize forums to solicit input from the public and concerned stakeholders.	42	1	4	3.36	.906
The health facility has protocols for adult, child and maternal health services from the MoH.	42	1	4	2.86	1.317
The facility managers ensure that Health workers follow protocols, standards and codes of conduct.	42	3	4	3.83	.377
The health facility collects and analyses local data.	42	2	4	3.81	.455
The health facilities receive regular external quality check team to ensure that the protocols and standards are followed.	42	1	4	3.52	.943
The allocation and utilization of resources are regularly tracked and information on results is available for review by the local communities/stakeholder.	42	1	4	3.43	.966
There is a mechanism for correcting those not complying with standards and code of conduct.	42	1	4	2.48	1.194
The public and concerned stakeholders have the capacity to advocate and participate effectively with the health facility officials in making plans.	42	1	4	3.19	.969
There are procedures and systems that clients, providers, and concerned stakeholders can use to fight bias and inequity in accessing health service.	42	1	4	3.38	.909
Health services are organised and financed in ways that offer incentives to health workers and community health workers to improve performance.	42	1	4	2.88	1.131

In the Transparency latent factors highest loading of 0.776 was in the item relating to "facilities receiving regular external quality check team to ensure that the protocols and standards are followed". In the regulation & oversight factor the highest loading of 0.834 was in the item "managers ensure that Health workers follow protocols, standards and codes of conduct". In community participation latent factor highest loading of 0.781 was in the item "Local organizations and health service users have influence on what services are offered at the health facility". In the intelligence and vision latent factor, the highest loading of 0.827 was in the item "Health facility managers rely on research data from health facility to plan services". In the accountability latent factors the highest loading of 0.783 was in the item "Systems exist for reporting, investigating, and adjudicating misallocation or misuse of resources" (Table 2).

Sub group analysis of governance domains

District governance score

Chongwe performed poorly in overall mean governance score and across the five domains of governance. The overall scores in Chongwe ranged between 51 and 94% with the mean of 80%. For Chongwe district, the highest score by domain was in regulation and oversight (95%) and the lowest score was in Transparency domain (73%). Kafue and Luangwa had similar overall mean governance scores (88%). For Kafue the scores ranged between 75 and 98%. The highest score was noted in the regulation & oversight (95%) and the lowest scores in the transparency domain (83%). Luangwa district scores ranged between 73 and 98%. The highest score was in accountability (96%) lowest scores were in intelligence & vision domain.

When domains were compared across the three districts, Accountability and transparency domains were highest in Luangwa and lowest in Chongwe. Intelligence & vision sub scores were highest in Kafue. Regulation & Oversight showed less variation across the districts (Table 3 and Figure 1).

Governance score stratified by residence

The overall mean score by residence was similar for peri urban and hospital and slightly higher for rural (84%). The overall score ranged from 51 to 98% in Peri urban and 64 to 98% in rural residence. For hospital based health facility scores ranged between 72% and 94%.

There was variation in the score by different domains with accountability showing the highest variation. The lowest accountability score were noted in the hospital (63%) and highest in the rural health facilities (87%). Community participation was highest in the rural (89%)

Table 2 Factor analysis for the 16 item governance score

	Latent factor				
	Transparency	Regulation & oversight	Community participation	Intelligence & Vision	accountability
The health facilities receive regular external quality check team to ensure that the protocols and standards are followed.	.776				
The allocation and utilization of resources are regularly tracked and information on results is available for review by the local communities/ stakeholder.	.724				
There is a mechanism for correcting those not complying with standards and code of conduct.	.654				
The public and concerned stakeholders have the capacity to advocate and participate effectively with the health facility officials in making plans.	.617		.		
There are procedures and systems that clients, providers, and concerned stakeholders can use to fight bias and inequity in accessing health service.	.610				
Health services are organised and financed in ways that offer incentives to health workers and community health workers to improve performance.	.566				
The facility managers ensure that Health workers follow protocols, standards and codes of conduct.		.834			
The health facility collects and analyses local data.		.797			
Local organisations and health service users have influence on what services are offered at the health facility.			.781		
There are forums and procedures that give the public, technical experts, and local communities' opportunities to provide input.			.768		
The health facility use evidence on program results, patient satisfaction, and other health-related information to improve the services they deliver.			.546		
Health facility managers rely on research data from health facility to plan services.				.827	
The health facility regularly organize forums to solicit input from the public and concerned stakeholders.				.685	
The health facility has protocols for adult, child and maternal health services from the MoH.				.501	
Systems exist for reporting, investigating, and adjudicating misallocation or misuse of resources.					.783
The public/concerned stakeholders have regular opportunities to meet with managers of the health facility to raise issues about service efficiency or quality.					.763

Extraction Method: *Principal Component Analysis*. *Rotation Method*: *Varimax with Kaiser Normalization*.

and lowest in the hospitals (75%). Transparency was however lower in the rural health centres when com- pared to peri urban and hospital based health facilities (Table 4 and Figure 2).

Qualitative results

Community participation and accountability were some elements of governance that showed poor performance across the study district either in isolation or in combination. We further explored these concepts using qualitative methods to establish what communities and health workers think about these elements of governance.

Community participation in health services

Community participation was generally low and was assumed rather than seen in practice. Most health workers interviewed said that communities participated actively in running of the health facility but at the same time acknowledged that this was mainly through community representatives who were not always active. The said community participation was inconsistent and was mainly around national campaign days such as child health week. Community participation was better in rural health facilities because of the existence of traditional structures which made it easy to organize community members. This was not the case in peri urban areas were communities

Table 3 Governance score stratified by district

District	Domain	N	Mini	Max	Mean	Std.
Chongwe	Accountability	21	25.00	100.00	75.5952	25.76219
	Community participation	21	50.00	100.00	87.3016	17.79885
	Intelligence & Vision	21	41.67	100.00	80.1587	17.77096
	Regulation & Oversight	21	75.00	100.00	95.8333	8.22851
	Transparency	21	25.00	100.00	72.8175	20.81745
	Total Score	21	51.56	93.75	80.1339	11.47287
Kafue	Accountability	14	75.00	100.00	92.8571	8.07758
	Community participation	14	50.00	100.00	83.9286	14.42053
	Intelligence & Vision	14	58.33	100.00	91.6667	12.65924
	Regulation & Oversight	14	62.50	100.00	94.6429	11.72018
	Transparency	14	66.67	95.83	83.3333	9.80581
	Total Score	14	75.00	98.44	87.6116	7.18552
Luangwa	Accountability	7	75.00	100.00	96.4286	9.44911
	Community participation	7	66.67	100.00	88.0952	13.48623
	Intelligence & Vision	7	50.00	100.00	79.7619	15.85316
	Regulation & Oversight	7	87.50	100.00	96.4286	6.09938
	Transparency	7	66.67	95.83	86.9048	9.75053
	Total Score	7	73.44	98.44	88.1696	8.50365

were more heterogeneous and hence difficulty to organize. During focus group discussions, it was noted that there were gender differences in community participation. Male community members were more likely to participate in health facility initiatives and were well informed about services available at the health facilities and took part in the activities of the health facility. In contrast, most female participants were not aware of the activities that were going on at the clinic. However, when asked about who owned the health services at health facility, most respon- dents including women said that the health services were owned by the community despite their low participation.

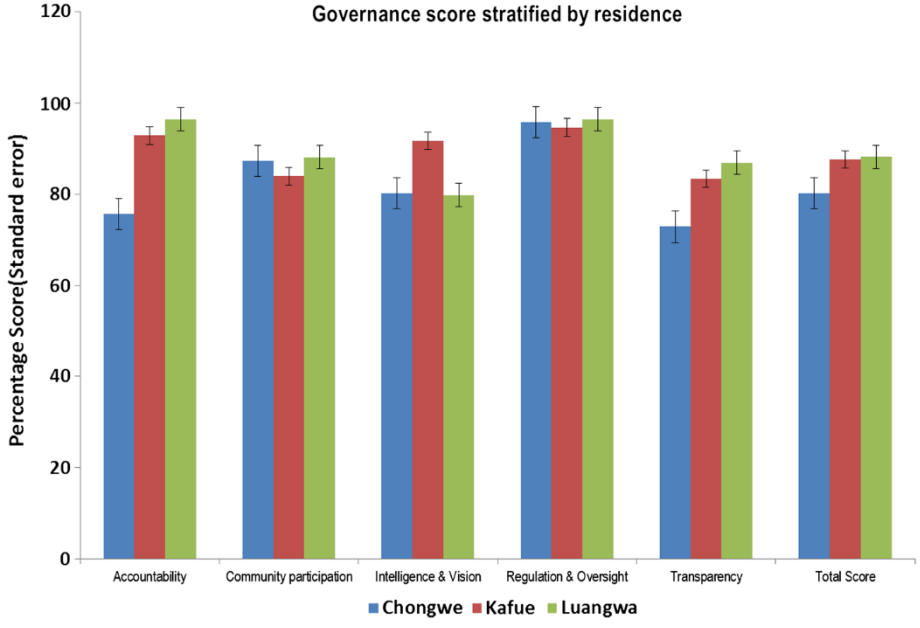

Figure 1 Governance scores stratified by district.

Table 4 Governance score stratified by residence

Residence	Domain	N	Mini	Max	Mean	Std.
Peri urban	Accountability	8	50.00	100.00	81.2500	18.89822
	Community participation	8	50.00	100.00	79.1667	21.82179
	Intelligence & Vision	8	50.00	100.00	79.1667	19.92048
	Regulation & Oversight	8	87.50	100.00	98.4375	4.41942
	Transparency	8	37.50	95.83	83.3333	19.28792
	Total Score	8	51.56	98.44	83.3984	14.53659
Rural	Accountability	32	25.00	100.00	87.1094	19.43879
	Community participation	32	50.00	100.00	88.8021	12.45231
	Intelligence & Vision	32	41.67	100.00	84.6354	15.99582
	Regulation & Oversight	32	62.50	100.00	94.5313	10.00882
	Transparency	32	25.00	100.00	77.2135	16.99885
	Total Score	32	64.06	98.44	84.1797	9.21187
Hospital	Accountability	2	25.00	100.00	62.5000	53.03301
	Community participation	2	50.00	100.00	75.0000	35.35534
	Intelligence & Vision	2	83.33	100.00	91.6667	11.78511
	Regulation & Oversight	2	100.00	100.00	100.0000	.00000
	Transparency	2	75.00	91.67	83.3333	11.78511
	Total Score	2	71.88	93.75	82.8125	15.46796

Accountability for the resources

We explored the extent to which the communities or their representatives held health workers accountable for resources especially drugs and medical supplies.

Generally, it was noted that community members lacked capacity to hold health workers accountable for drugs and medical supplies. Most community members including members of Neighbourhood Health Committees (NHC) assumed that the nurses and clinical officers accounted for the drugs and did not actively ensure that this was done and appeared quite ignorant of the process of accounting for the available drugs and medicines.

Discussion

In this baseline study, we validated a simple tool for measuring governance at health facility level. This is the

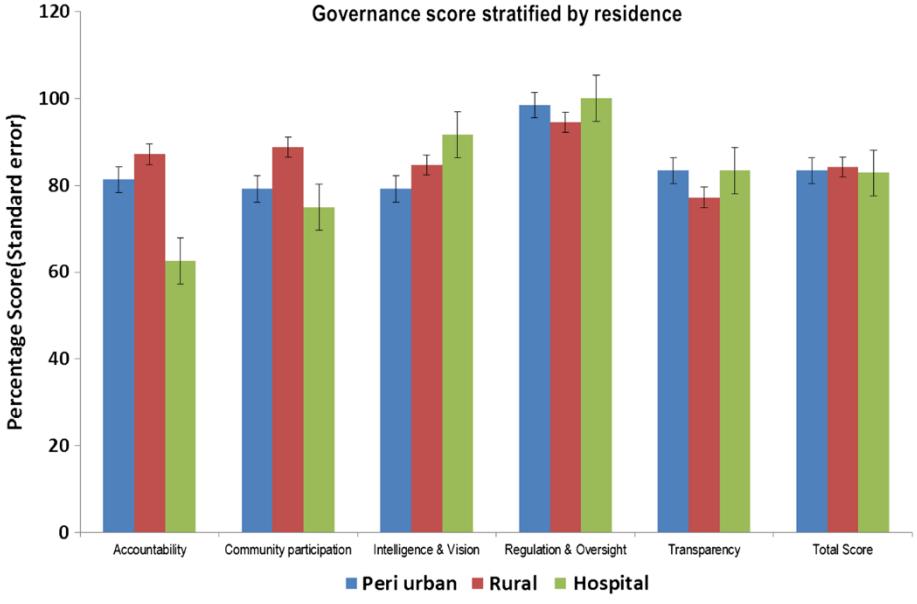

Figure 2 Governance scores stratified by residence.

first study to attempt to measure health system governance practices in Zambia with a focus on rural health centres. Most studies have focused on measuring health system governance at national, regional or district level and the questions used are usually not applicable at lower level of health system. In this study we did not attempt to measure global health governance but rather narrowed the concept of governance to the Zambian health care sys- tem and how governance can be measured at the lowest unit of health service delivery. The basis for this work was the online survey by the health system 20/20 where ques- tions were adapted and pre-tested so that they could be applicable at the lowest level of health care in Zambia [4,9]. The results have shown that it is feasible to measure governance practices at health facility level and that the adapted tool is fairly reliable for this purpose yielding a 95% one-sided confidence interval for Cronbach's alpha between 0.69 and 0.74 for the 16 items.

It must be mentioned from the outset that the mean scores for each item were generally higher suggesting a tendency to give higher scores by our respondents which is a common weakness with subjective evaluation [16]. Unlike the study by the 20/20 team where the respondents were not under any pressure to give higher scores, our respondents could not avoid the feeling of being evaluated by the study team despite our assurance. This bias was evident when comparing the responses to the governance questions with other observations findings on data collection and use. Generally there was little evidence on the collection and use of data yet the governance scores were still high in the items asking about collection and use of data. Despite this observation, some items had clearly low scores especially those items relating to the correction of those who do not adhere to protocols or code of practice and the availability of guidelines and protocols for child and adult health services.

Factor analysis yielded five principle components from the 16 items. One thing to note was that most of the items (6) clustered around the transparency latent factor or domain. Other latent factors had 2 or 3 items loading. The other factors identified were; community participation, intelligence& vision, accountability and regulation & oversight. These were in line with most of the governance domain suggested by Siddiqi et al., with a few elements on ethics and responsiveness not being captured by the 16 items [6]. This shows that the 16 items generally capture most of the components of governance and could be useful in comparing health facilities and tracking changes overtime. One advantage with the tool is that it is easy and quick to administer especially in busy health facilities were the managers might not have time to attend long qualitative interviews. The strength of the methodology was that rather than one person deciding the score the whole health facility team participated and came up with a consensus score for each item.

We compared baseline governance scores across the study districts and residence using the same tool. The results showed that overall score masked the clear variation across the governance domain. When domains specific comparison were made the differences between the districts and residence were very clear. Chongwe district performed poorly in overall governance score and across the five domains of governance when compared to Kafue or Luangwa districts. Most districts had poor scores in the transparency domain. Suggesting that most of the health facilities activities are not scrutinized by stakeholders or community. Our qualitative results supported these findings, as there was generally low community participation in health service delivery. We also observed that in most places, community members or their representatives were unable to hold health workers accountable for resources at the health services. Most of them were ignorant of how health workers accounted for drugs and medicines and simply trusted that it was being done well.

Residential variations were noted in the accountability and community participation which were better in rural areas and worst in hospital based health facilities. However transparency scores were lower in rural health facilities when compared to peri urban or hospital based health facilities.

The variation in the scores domain scores emphasizes the need to perform sub group analyses rather than simply relaying on overall scores which have been shown to mask the actual weakness in specific districts and residence in each domain.

The study had limitations; the overall mean scores were generally higher than anticipated. This could be attributed to the fact that this was a self administered tool and respondent were feeling pressured to give higher scores to avoid being rated low. Though the responses were based on consensus, the influence of managers on the overall response could not be eliminated though efforts were made to ensure that all the views of the respondents were considered when coming up with the final score. We also note that the results were based on 42 health facilities and therefore the results should be interpreted with caution. It is advisable to repeat the study with a larger sample size.

Despite these limitations, this tool could be useful in monitoring health system strengthening interventions targeting governance at health facility level in low income settings.

Conclusion

The study successfully validated and applied the new tool for evaluating health system governance at health

facility level. The results have shown that it is feasible to measure governance practices at health facility level and that the adapted tool is fairly reliable for this purpose with the 95% one-sided confidence interval for Cronbach's alpha laying between 0.69 and 0.74 for the 16 items. Caution should be taken when interpreting overall scores as they tended to mask domain specific variations.

Competing interests
The authors declare that they have no competing interests.

Authors' contributions
WM: Conceived the idea of applying systems thinking in evaluating the Intervention and drafted the paper. MTM: Contributed to writing of the paper and provided materials for the evaluation design. NS: Provided critical analysis and contributed to the writing of the paper. DB: Was involved in the draft of the paper and provided critical analysis of the scientific content. HA: Conceived the project and reviewed the draft and final manuscript. All authors read and approved the final manuscript.

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CHAPTER 6:

6. BASELINE STUDY: APPLICATION OF BALANCED SCORECARD

6.2. Research paper 4:

For research paper already published:

Tile: Measuring health system strengthening: Application of the Balanced Scorecard approach to rank the baseline performance of three rural districts in Zambia

Where was the work published: **Plos One**

When was the work published: **March, 2013**

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Was the work peer reviewed: **Yes**

Have you retained the right for the work: Yes

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For multi-authored work give full description of your role in the research and preparation of the paper:

I was a lead researcher on health system evaluation on the BHOMA project. Designed the study tools and took part in data collection. Performed all the data analysis and drafted the manuscript and was the lead author.

Candidate Signature:

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Supervisor or senior author's signature to confirm roles as stated:

_____

Measuring Health System Strengthening: Application of the Balanced Scorecard Approach to Rank the Baseline Performance of Three Rural Districts in Zambia

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Introduction

There is growing interest in health system performance and recently WHO launched a report on health systems strengthening emphasising the need for close monitoring using systems wide approaches [1,2,3]. This has been driven by the demand for performance improvement based on efficient use of limited resources in the presence of overwhelming health needs. Different approaches and methods have been used to measure health system performance, especially in high-income countries [3,4]. The WHO and the OECD, for example, have compared and ranked health systems across a range of functions and performance indicators. These exercises have sometimes been controversial but also difficult to achieve because of the complexity of comparing different health systems [5,6,7].

Health service planners and managers are faced with numerous challenges, not least having limited resources with which to provide services at an acceptable level of quality that are equitable and accessible to all. In order to monitor performance of interventions, various attempts have been made and one fairly recent method is the use of the balanced scorecard (BSC) system. The balanced scorecard is derived from the private business 'balanced scorecard' approach, a strategic management tool that was first suggested by Robert Kaplan and David Norton in 1992 [8]. The idea is that a scorecard provides information on areas of strategic importance to guide future planning, but also serves as a

snapshot of how well an organization or system is performing [7]. A balanced scorecard is made up of domains and indicators derived from the strategic vision of an organisation aimed at measuring its performance. The design and implementation of the balanced scorecard process can be separated into four stages: (1) translating the vision and gaining consensus; (2) communicating the objectives, setting the goals, and linking strategies; (3) setting targets, allocating resources, and establishing milestones; (4) feedback and learning. [9,10]. Originally the balanced scorecard approach was based on four different perspectives of equal weight: learning and growth, internal processes, customer satisfaction, and financial performance. However, when applied to the healthcare sector, the four traditional perspectives needed further modification to better reflect the particular functions of the public health sector [11]. Balanced scorecards have been used in healthcare monitoring and evaluation at patient, facility, district and national level but mostly in high income countries [12]. The WHO endorsed the balanced scorecard approach in evaluating health system strengthening interventions in low income countries [13]. One study conducted in Afghanistan used the balanced scorecard approach to evaluate the performance of the health system based on selected indicators over a period of five years. In this work Edward et al, (2011) made important modifications to the traditional balanced scorecard. They included domains such as patient and community, human resources, service provision and health system preparedness indicators for equipment, essential commodities and infrastructure [9,14]. We adapted and applied the BSC approach in the context of the Zambian health care system. The Zambian health system is comprised of 9 Provincial Health Offices, 72 District Health Offices, 98 hospitals, 265 urban health centers, 1,029 rural health centers, and 171 health posts. Health centers are intended to serve 30,000 to 50,000 people in urban areas and 10,000 people in rural areas, within a 29 kilometer radius catchment area. Human resource challenges for the health sector in Zambia are well documented [15]. Shortage of skilled health workers constitutes a very important bottleneck to service delivery. According to records from Ministry of Health (MOH), the total number of staff in the health sector stands at 29,533, this is 57 percent of the approved establishment. Less than 50% of frontline health workers (nurses, midwives, clinical officers, Environmental Health Technicians, (EHT)) are available in relation to the need [16].

Public health facilities in rural and remote areas have the lowest number of health workers compared to urban areas [16]. The result is that there are a number of Health Posts and Rural Health Centres which are run by unqualified staff or have only one qualified staff [15,16]. Other major bottlenecks in health service delivery include weak health infrastructure, inadequate drugs and medical supplies and poor funding. These have been captured as the major focus areas for the MOH 2011 strategic plan [16].

The Better Health Outcome through Mentoring and Assessment (BHOMA) project is a randomised step wedged community trial that aims to strengthen health systems in three Lusaka districts. Before the implementation of the BHOMA intervention, a baseline study was undertaken to determine the baseline characteristics of all the health facilities taking part in the study. We adapted the domains by Edward et al, (2011) to describe the baseline status of all participating health facilities in line with the vision of the Zambian MOH as articulated in the Strategic Plan of 2011 [16].

Methodology

The BHOMA project targets to strengthen the health system in Chongwe, Kafue and Luangwa covering 48 health facilities (6 pilot sites and 42 intervention sites). The combined population for the three districts is 306,000. Two of the health facilities included in the BHOMA study are affiliated to mission hospitals. These are Katondwe and Mphanshya health facilities which act as outpatient departments for the respective hospitals. Mphanshya mission hospital is in Chongwe district. It has a bed capacity of 90, while Katondwe mission hospital is the main referral hospital in Luangwa district with a bed capacity of 80. All the mission hospitals are well staffed and funded with the help from Churches Association of Zambia (CHAZ). They all offer inpatient and outpatient services, laboratory and X-ray services. Therefore the hospital affiliated health facilities are well supported in terms of staffing and resources compared to other rural health facilities.

The BHOMA model is made up of three primary strategies designed to work at different levels of the health system. These are District, health facility and community strategies. Following is a summary description of the three BHOMA strategies.

The district strategy

Each of the three districts has one Quality Improvement (QI) team that implements the intervention in target health facilities. Each QI team consists of two nurses and one clinical officer. The teams work closely with the district clinical care specialist who represents the interest of the Ministry of Health. The district QI team is supported by the central Quality Improvement team that provides technical and logistical support to the district teams. The district team implements the intervention in target health facilities in line with the predetermined randomised step wedged design. At the health facility, the QI team works intensively with local clinic staff to build clinical skills, applying clinical protocols and algorithms, completing forms, and reviewing patients together. They work one-on-one to mentor about good patient consultation, ordering appropriate investigations, interpreting results, and working through diagnoses.

The health facility strategy

The health facility-based intervention aims to improve clinical care quality by implementing practical tools that establish clear clinical care standards, providing essential resources to meet these standards and communicating standards through intensive clinic implementations. Each clinic generating self assessment reports that help identify areas of weakness for further improvement with support from the QI team. Leadership training is provided to the health workers targeting governance, finance, supply chain and human resource management. Staffing support consists of community workers trained as ‘ ‘Clinic Supporters.’ ’ These lay workers are trained to assume as many non-clinical duties as possible. These include registration of patients, filing, triaging, recording vital signs, fast tracking urgent cases and routing patients through services.

The community strategy

The BHOMA project has engaged community health workers on part time basis each earning about $60 per month. They are trained in providing preventive services and tracking missed clinic appointments. They work in collaboration with community health units known as Neighbourhood Health Committees (NHCs) and Traditional Birth Attendants (TBAs).The community health workers are also being trained in capturing and recording local health data and sending it to health facilities via mobile phones or

Table 1. Sample profile for the baseline study in the three BHOMA districts.

Sample profile		Baseline number
Districts		3
Facilities		42
Patient observations:		
	Children	202
	Adults	208
Total		410
Exit Interview		
	Children	209
	Adults	220
Total		429
Health provider interviews		96

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physically. In order to ensure objective evaluation, the BHOMA study has a separate evaluation team.

The evaluating team is composed of health systems experts, epidemiologists and anthropologists. There is a close collaboration between the implementation and the evaluation teams.

Health facility survey

A baseline health facility survey was conducted in 42 out of 48 health facilities found in the three BHOMA districts. This constituted 96% of the total health facilities with the rest being used as pilot sites for the BHOMA intervention. The study was conducted between January and May 2011. At each health facility a number of questionnaires were administered, targeting health facility managers, health workers and patients. At each health facility the health facility incharge was interviewed, in addition to two other health workers. At each health facility, five adult observations were done irrespective of the presenting complaint. Children were observed if they were under five years and presenting with fever, cough or diarrhoea. Similarly, five exit interviews for adults and five for under five child/guardian pair were done. The recruitment was consecutive until the required number was reached. (See Table 1)

The selection of indicators was done in three stages. Firstly, available tools and indicators from WHO, Measure Evaluation Facility Surveys and Health Facility Assessment Network (HFAN) were reviewed. Relevant indicators to the domains of interest were selected some of these have been used in previous health facility surveys in Zambia. In the second place, consultations were held with the district and health facility managers to review the indicators and agree on which ones best would address the domains of interest. The tools and indicators were then pre-tested in pilot sites within the BHOMA intervention area and adaptations were made based on pre-test experience. Verbal responses were validated through inspection and physical obser- vation.

Data collection was conducted by the evaluating team composed of a team leader who is a medical doctor and an epidemiologist and fifteen sixth year medical students who were research assistants. Data collectors were trained for five days on how to administer the study tools. Main hospitals and private clinics were excluded from the study. However, hospital affiliated health facilities were included. Health posts were considered as part of the health facility to which they referred patients. Appointments were made with health facility managers prior to the day of data collection.

Household survey

A household survey was conducted in a random sample of 120 households which fell under respective target health facilities. Households were eligible for inclusion in the study if they had any person above 18 years of age. The households were enumerated and a standardised questionnaire based around validated demographic and health indicators from the Demographic and Health Survey (DHS) were used. In addition, questions were asked about health seeking behaviour, key coverage indicators for both adult and children. A total of 39,012 respondents were approached to take part in the survey. 246 refused to take part giving a refusal rate of 0.6%. The full methodology of the BHOMA intervention is described elsewhere [17].

Data analysis

Data were entered onto an Access database and exported to SPSS version 19 for analysis. Simple frequencies were used to analyse and explore the data. Comparisons were made between health facilities and districts based on the modified balanced scorecard approach. The analysis utilized indicators reflecting the 2011 MOH Strategic Plan. These were: Service delivery (availability and quality); human resources (motivation and training); finance (availability of action plans and training); service capacity (basic infrastructure, basic equipment, laboratory capacity, tracer drugs and infection control). Patient perspectives were elicited through exit interviews and clinical observations. Gender differences in service satisfaction were used to assess equity of access as reflected in the vision of the Ministry of Health in Zambia. This was taken as a proxy to overall vision as required when applying balanced scorecard approach. In addition, we calculated coverage scores for 6 indicators of access to health

Table 2. Summary of indicators used to calculate Service coverage score in the household survey.

	n	(%)
1. Children with diarrhoea in the last two weeks and seeking treatment	190	42.4
2. Children with cough in the last two weeks and seeking treatment	190	76.6
3. Children with fever in the last two weeks and seeking treatment	258	73.9
4. Adults with high blood pressure on treatment	680	28.7
5. Adults with HIV and on ART	1032	75.9
6. Women on some form of contraception	5037	52.5

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Table 3. Baseline demographic characteristics of the health facilities in the BHOMA study.

Variable		n	%
Residence			
	Peri urban	8	19.0
	Rural	32	78.5
	Hospital	2	5.0
Bed capacity			
	No overnight bed	9	21.4
	1–3 beds	7	16.7
	4–5 beds	7	16.7
	6+ beds	19	45.2
Number of health workers			
	Two	5	11.9
	Three	3	7.1
	4–5	13	31.0
	Six plus	21	50.0
Private consultation room			
	Yes	42	100.0
Phone availability			
	No	4	9.5
	Yes	14	33.4
	Use personal mobile phones	24	57.1
Access to ambulance			
	No	31	73.8
	Yes, Functional with fuel	10	23.8
	Yes, not functional	1	2.4
Power Source			
	No	5	11.9
	Electricity	23	54.8
	Solar energy	13	31.0
	Generator	1	2.3
Power working today			
	Yes	30	81.1
	Not functional	7	18.9
Water source			
	Safe protected Source	41	97.6
	Unprotected source	1	2.4
Toilets for clients			
	No toilet	1	2.3
	Yes Improved pit latrines	40	95.4
	Flush toilet	1	2.3
Condition of toilet			
	Functional	40	97.6
	Not functional	1	2.4

doi:10.1371/journal.pone.0058650.t003

services (3 for adult and 3 for child health) (Table 2). We applied linear regression to establish correlations between the different domains of health service delivery.

Ethical considerations

The study was approved by the University of Zambia Bioethics Committee and the London School of Hygiene and Tropical Medicine Ethics Committee. All respondents were informed about the purpose of the survey and were asked to sign a consent form before taking part in the study. Confidentiality was ensured during data collection and subsequent publication of the results.

Results

Characteristics of sampled health facilities

Forty two health facilities were included in the sample: 21 in Chongwe, 14 in Kafue and 7 in Luangwa district. Nineteen percent (8/42) of the health facilities were classified as peri-urban, while 78.5% (32/42) were classified as rural. Five percent (2/42) were attached to a mission hospital and served as outpatients departments. Twenty one percent of the health facilities had no overnight bed capacity. Fifty percent of the health facilities had at least 6 health workers, some of whom were not formally trained but assisted in reviewing patients. All of the health facilities had a private room for examining patients with visual and audio privacy. Most health workers used their own mobile phone for communication in their work place (57%) with less than 35% having access to work place communication facilities.

Seventy three percent of the facility managers said they did not have access to emergency ambulance services. The majority of the facilities had access to power either through electricity (54.8%) or solar energy (31%). Out of those who said they had access to power about 20% said it was not functional on the day of data collection. Most health facilities had access to safe drinking water and improved type of pit latrines. (See Table 3).

Patient domain

The patient domain had separate satisfaction indices for children and adults (Tables 4 and 5). Overall adults' satisfaction scores were higher than children's scores (based on parent/ guardian responses). Children satisfaction scores ranged between 58% and 65%, while adult scores ranged between 70% and 76%. Children's satisfaction scores were lowest in Kafue (58%) and highest in Chongwe (65%). The highest score for adult satisfaction index was in Luangwa (76%) and lowest in Kafue (70%).

When comparing the satisfaction scores by residence, scores were generally lower for children when compared to adults. Across the three districts children's satisfaction scores were below 65%.There was little variation between the residence in children scores with peri-urban and hospital-based health facilities scoring about 63% and rural health facilities scoring 62%. In contrast, adults' scores showed some variation with highest score in hospital based health facilities (75%) and lowest in the peri-urban health facilities (71%). (See Tables 4 and 5).

Service capacity domain

This domain comprised six indices, each made up from an aggregate of indicators. Across the three study districts the basic infrastructure score was similar at 76%. Basic equipment and laboratory capacity scores showed major variation with Kafue and Luangwa having lower scores when compared to Chongwe. For basic equipment Luangwa scored lowest (65%), followed by Kafue (67%). Chongwe had the highest basic equipment score of 84%, and the laboratory capacity score was lowest in Kafue (63%) and highest in Chongwe (77%). Infection control scores were highest in Luangwa (90%) and lowest in Kafue (80%).

Tracer drug scores showed little variation across the three districts, all of which scored above 87%. When residential

Table 4. Baseline District Performance in Six Health System Domains.

Domain	Districts scores(mean)		
Domain A: Patients and community:	Chongwe	Kafue	Luangwa
Patient satisfaction children index	65.4	58.3	61.9
Patient satisfaction Adult index	72.9	70.1	76.3
Service coverage Children index	71.8	73.	76.4
Service coverage Adult index	51.0	52.5	57.1
Domain B: Human resources			
Health worker motivation scores	88.8	86.0	90.5
Training in the past 12 months	72.2	58.6	76.9
Domain C: Service capacity			
Basic Infrastructure index	76.9	76.4	75.8
Basic equipment index	84.0	67.1	65.0
Laboratory capacity index	76.5	62.5	67.0
Tracer drugs index	87.9	87.6	88.4
Infection control index	82.0	80.2	88.9
Domain D: Finance			
Finance index	*47.6	44.0	66.7
Domain E: Governance domain	80.1	87.6	88.1
Domain F: Service provision			
Service readiness index	69.7	65.6	68.6
Clinical observation index (Children)	*31.9	71.0	72.7
Clinical observation index (Adults)	54.4	34.3	45.7
Service coverage Children index	71.8	73.	76.4
Service coverage Adult index	51.0	52.5	57.1
Domain: Overall vision:			
Service satisfaction index by Gender:			
Male	74.4	63.6	76.8
Female	72.2	72.7	76.1

**The mean difference is significant at p,0.05, using ANOVA.*

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Table 5. Baseline Performance Stratified by Residence in the Six Health System Domains.

Domain	Residence mean scores		
Domain A: Patients and community:	Peri urban	Rural	Hospital
Patient satisfaction children index	63.5	62.2	63.0
Patient satisfaction Adult index	70.6	72.8	75.5
Domain B: Human resources			
Health worker motivation scores	86.7	88.6	87.7
Training in the past 12 months	50.0	74.3	66.7
Domain C: Service capacity			
Basic Infrastructure index	78.8	76.2	73.1
Basic equipment index	72.5	76.3	70.0
Laboratory capacity index	81.3	67.6	68.8
Tracer drugs index	87.2	87.4	97.0
Infection control index	76.4	83.0	100
Domain D: Finance			
Finance index	*42.9	53.9	16.7
Domain E:Governance			
Governance index	83.4	84.1	82.1
Domain E: Service provision			
Service readiness index*	64.1	68.7	76.5
Clinical observation index(Children)	53.8	50.0	70.0
Clinical observation index (Adults)	42.5	46.5	55.6
Service coverage Children index	71.7	73.2	81.3
Service coverage Adult index	57.8	51.2	51.5
Domain: Overall vision:			
Service satisfaction index by Gender:			
Male	64.2	73.2	77.5
Female	73.3	72.6	75.0

**The mean difference is significant at p,0.05, using ANOVA.*

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comparisons were made, basic infrastructure and basic equipment scores were lowest in hospital-based health facilities (73% and 70% respectively), and the highest scores for basic infrastructure were in the peri-urban health facilities (78%) and rural health facilities for basic equipment (76%). Laboratory capacity had a lower score in rural (68%) and hospital-based health facilities (69%) and was highest in peri-urban health facilities. Infection control was best in hospital-based health facilities (100%) and worst in peri-urban health facilities (76%).Tracer drugs had high scores across the three residential areas (all above 87%). (See Figures 1 and 2).

Service provision domain

This domain comprised three indices: firstly whether health facilities offered ten selected essential health services and whether guidelines or protocols were available for each and the availability and recent use of service registers. The second index looked at clinical practice with a focus on under five and adult clinical observations with an overall score for clinical observation for each case observed. The third index looked at community coverage of specific child and adult services. The results showed that scores for this domain across the three study districts were below 80%. Lowest scores for service provision were reported in Kafue (66%) and highest for Chongwe (69%).

Clinical observations showed poor scores for Chongwe (31%) while Kafue and Luangwa showed relatively high scores of 71% and 73% respectively. The differences were statistically significant (p,0.05) Stratified analysis by residence showed that peri-urban health facilities had the lowest scores (64%) while hospital-based health facilities had the highest scores (77%). Adult clinical observations scores were all below 60%. Children' s clinical observation score was lowest in rural (50%) and highest in hospital-based health facilities (70%).

Service access coverage score showed no significant difference across the three districts and residence, though adult scores tended to be lower than children scores (Adult range: 51 – 57%: Children range: 71 – 82%). (Table 4 and 5).

Human resources domain

The human resources domain had two separate indicators. One was a measure of the health worker motivation (a composite of 23 items affecting motivation, details are described elsewhere [18]) and the second was the proportion of interviewed health workers who had received training in the preceding 12 months. The results showed generally high mean scores for motivation across the three

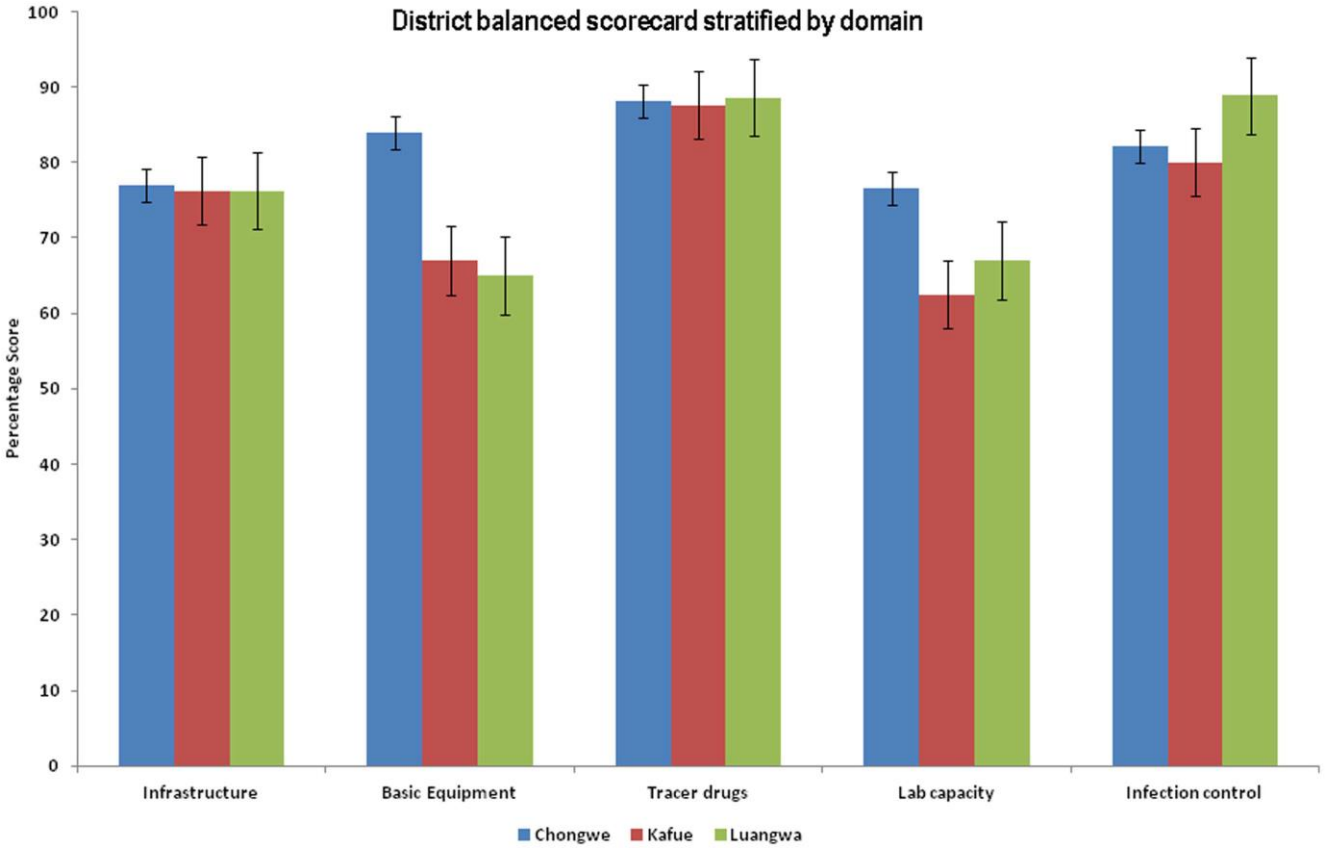

Figure 1. District balanced Scorecard stratified by domain. This figure shows district scores stratified by domain. The domain comprised six indices, each made up from an aggregate of indicators. Across the three study districts the basic infrastructure score was similar at 76%. Basic equipment and laboratory capacity scores showed major variation with Kafue and Luangwa having lower scores when compared to Chongwe. For basic equipment Luangwa scored lowest (65%), followed by Kafue (67%). Chongwe had the highest basic equipment score of 84%, and the laboratory capacity score was lowest in Kafue (63%) and highest in Chongwe (77%). Infection control scores were highest in Luangwa (90%) and lowest in Kafue (80%).
doi:10.1371/journal.pone.0058650.g001

study districts (all above 85%).The highest scores were reported in Luangwa (90%) and the lowest scores were noted in Kafue (86%).The proportion of health workers receiving training in the past 12 months was lowest in Kafue (58%) and highest in Luangwa district (77%).

When stratified by residence mean motivation scores remained high across the three residence areas. However, rural residence had a slightly higher mean motivation score when compared to peri-urban or hospital-based health facilities. In terms of training received, peri-urban health facilities had the lowest proportion of health workers who received training (50%).The highest number of health workers receiving training was in rural health facilities at 72%. (Tables 4 and 5).

Finance system domain

This domain was compiled from three indicators: the availability of a costed action plan (reported or seen), the availability of a person in charge of finance (part or fulltime) and whether the person in charge of finance had received finance training in the last 12 months.

Results showed that Kafue and Luangwa had lower scores in this domain: 44% and 47% respectively, while Chongwe district scored 66%. Wide variation was noted across different residences with hospital-based health facilities scoring lowest at 17%, followed by peri-urban facilities at 43%. Rural health facilities had the highest finance score of 53%). (Table 4 and 5).

Overall vision

The overall vision was captured by analyzing service satisfaction stratified by gender.

A major gender difference in service satisfaction was noted in Kafue where males showed a lower satisfaction score (64%) when compared to female responders who had a score of 73%.Chongwe and Luangwa showed little variation in scores between males and females. Stratified analysis by residence showed that males in peri-urban health facilities had lower scores when compared to females (male: 64%; female 73%). In both rural and hospital-based health facilities there was a tendency towards males having higher scores when compared to females, but the differences were minimal. (Tables 4 and 5). Linear regression revealed no significant gender differences in adult service satisfaction score after controlling for education status, presenting problem, district and residence. (See Table 6).

Linear regression analysis of the association between the different measures of quality of care

Children clinical observation scores were correlated with drug availability (coeff 20.40, $p=0.02$) and Chongwe district (coeff

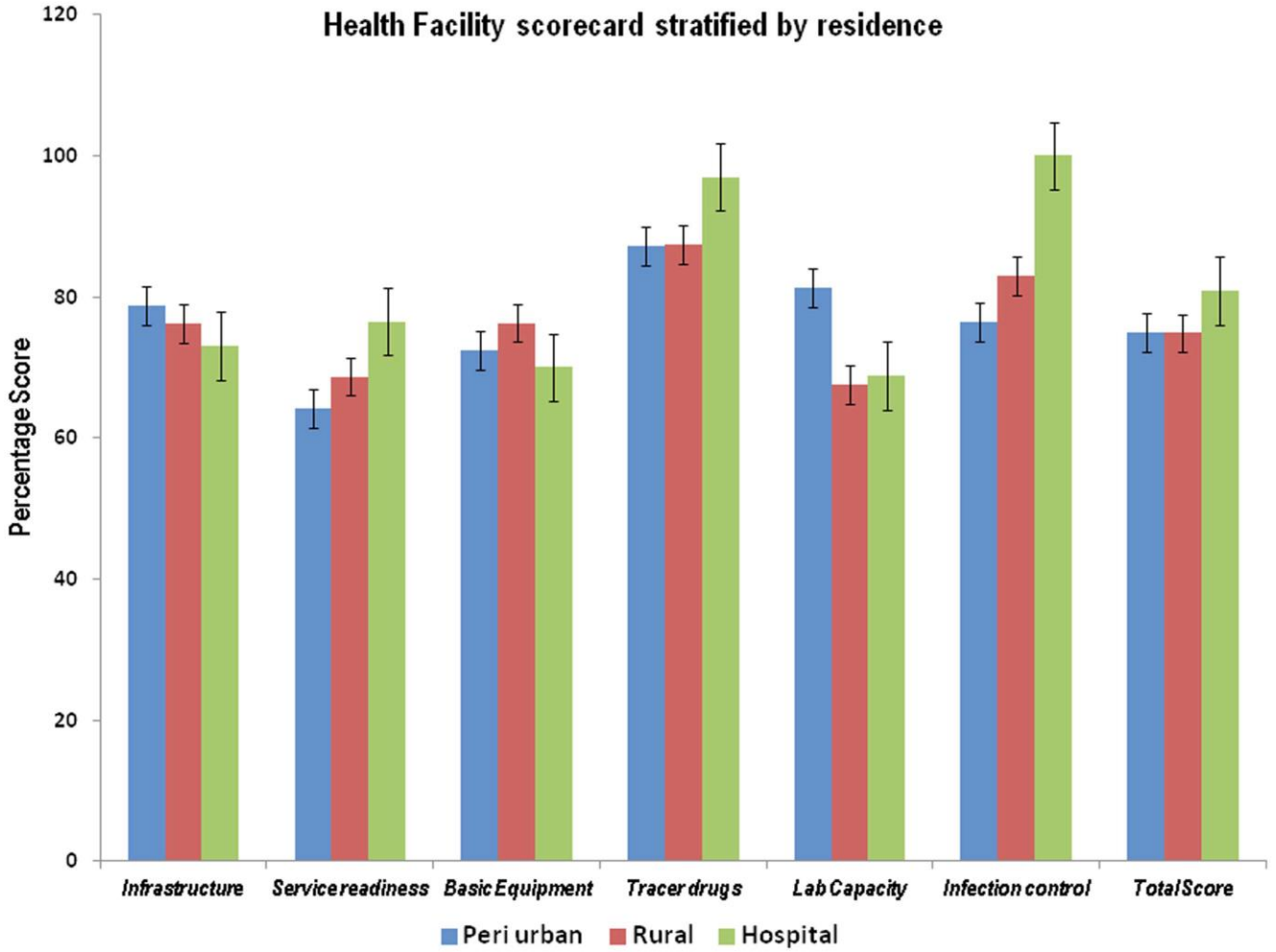

Figure 2. Health facility scorecard stratified by area of residence. This figure shows residential scores which are stratified by domains. It shows that basic infrastructure and basic equipment scores were lowest in hospital-based health facilities (73% and 70% respectively), and the highest scores for basic infrastructure were in the peri-urban health facilities (78%) and rural health facilities for basic equipment (76%). Laboratory capacity had a lower score in rural (68%) and hospital-based health facilities (69%) and was highest in peri-urban health facilities. Infection control was best in hospital-based health facilities (100%) and worst in peri-urban health facilities (76%).Tracer drugs had high scores across the three residential areas (all above 87%).
doi:10.1371/journal.pone.0058650.g002

20.43 , p = 0.05). The relationship however appeared to be negative meaning that having high drug availability score did not necessarily lead to better clinical care. Chongwe district had a negative association with children clinical observation score suggesting that clinical observations were worse in Chongwe when compared to Kafue which was the reference district. (Model 1). Model 2 shows that adult clinical observation scores were positively associated with adult service satisfaction score (coeff 0.82, p = 0.04) and service readiness (coeff 0.54, p = 0.03), but was negatively associated with motivation scores (coeff 20.40, p = 0.03), meaning that higher motivation score did not necessarily translate into better quality of care. In fact the relationship appeared to be the opposite. Children satisfaction scores were positively associated with governance scores (coeff 0.35, p = 0.05) as shown in model 3.

Models 4, 5, and 6 show no significant association between adult service satisfaction, service coverage (adult and children) with all the independent variables at baseline. (See Table 7).

Discussion

The study has shown that it is feasible to use a balanced scorecard approach to rank the performance of health facilities and their respective districts. The indicators used in our study are well documented and widely used in low income countries and recommended by WHO for heath facility surveys [13,19]. We adapted the indicators after extensive consultations with participating districts in order to address the specific Zambian health sector context [20,21]. The major strength of the study was that we included almost all health facilities in the three study districts apart from pilot sites which made up less than 10% of the total number health of facilities in the study districts.

This work is the first successful application of the balanced scorecard approach to measuring health system performance in Zambia and marks the beginning of an ambitious project to monitor the performance of health system interventions in these target districts for the next four to five years. The methods we used for our study could apply to other health facilities in Zambia with similar rural settings. The evidence generated in this study will

Table 6. Linear regression model of determinants for Adult service satisfaction score.

	Coeff	Std error	P
(Constant)		6.34	.00
Chongwe	.12	1.90	.12
Luangwa	.19	2.71	*.02
Male sex	.04	2.19	.63
Peri urban	2.04	2.30	.63
Hospital	2.01	4.23	.98
Years in school	.017	.25	.82
Presenting problem:			
Antenatal	.28	5.93	.20
HIV treatment	.01	8.60	.92
Voluntary Counselling & Testing (VCT)	.07	13.95	.38
Tuberculosis Treatment	.01	14.07	.89
Malaria/fever	.01	5.77	.95
Other services	.08	5.90	.73

* = P,0.05.

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help target and adapt the current health system intervention to respond to specific district and health facility needs.

By using a balanced scorecard approach several barriers to providing quality healthcare were highlighted. One important observation was that each district performed well/less well in different domains depending on the residential location of each health facility. This finding emphasises that ''one size fits all'' interventions may not work well as challenges vary between district and health facility. This means that interventions to strengthen the health system need to be based on current evidence and adapted to suit individual districts and health facilities. In this regard, the use of balanced scorecard approaches or similar tool is essential to monitor the performance and improvements resulting from health system interventions.

In the patient domain, children's service satisfaction scores (based on parent/guardian ratings) were generally lower com- pared to those of adults' ratings. This could be attributed to the nature of child services which are usually specialised requiring health workers to receive specific training [22,23]. It could also be due to the fact that more attention is paid when adult patients come for consultation. Service satisfaction scores also varied between districts and residences. Among the three districts, Kafue showed poor scores in both adult and children service satisfaction scores. This could be due to the fact that Kafue is fairly urbanised compared to Luangwa and Chongwe and had a high patient load, which could affect the quality of services and hence the poor scores. It was noted that hospital-based health facilities had better service satisfaction scores compared to rural and peri-urban health facilities. This could be attributed to the availability of qualified health workers and the support given by the mission hospitals to which they were attached. There were at least two clinical officers at each of the hospital-based health facility and referral systems were within the same premises.

Within the human resource domain overall health worker motivation scores were generally high across the study districts and residence. This could be attributed to reporting bias where health workers tended to rate themselves higher than normal as they felt this was desired [24]. Despite this observation there was a tendency towards higher scores for rural health workers when compared to peri-urban and hospital-based health facilities. This is a surprising finding and needs further research as to why rural health workers appeared more motivated when they worked in highly deprived areas where health workers are often unwilling to work. Indeed, motivation and rural origin have been found to be important factors in willingness to work in the rural areas in Rwanda and Ethiopia [25].

Service capacity showed little variation in terms of the availability of basic infrastructure across the three districts. However, substantial variations were noted in the availability of basic equipment and laboratory capacity. Chongwe district scored highly in both indices compared to the two other districts. It is not clear why this was the case but the presence of key partners appeared to favour equipment and laboratory capacity.

The finance domain showed poor scores overall across the three study districts. The data suggest that there are poor financial records and a lack of training in financial management for those in charge of financial record keeping. With the current calls to improve efficiency and accountability in the use of limited

domain [26].

Service provision was another domain which showed relatively low scores across the three study districts. Similar findings of low scores at baseline in the service delivery domain were reported in Afghanistan [14]. This finding was not surprising as this domain required health facilities to have guidelines and protocols for various services offered and to actively use them. Physical inspection was used to validate the information given verbally. Most health facilities lacked guidelines and protocols for different health services hence the poor scores recorded in this domain. We therefore recommend that the current health system strengthening intervention gives priority to this domain in order to improve the quality of care given to patients.

Overall vision was captured through gender equity in service satisfaction. There were differences between districts. Generally, males tended to have lower satisfaction scores when compared to females. This could partly reflect the orientation of services towards women and children and less so for men [27]. These gender differences need to be addressed if the vision of equity in access to health care is to be achieved.

There are considerable arguments on what is required to improve quality of service delivery in low income countries. Differential emphasis has been placed on various aspects of quality of care. Some authors have emphasised technical capacities while others have placed emphasis on the process and structural capacities. Which of these is more important still remains a matter of debate and there is conflicting literature. It appears that both technical and structural qualities are important but not sufficient in their own right to improve quality of care [28]. Leonard K et al, 2007 used satisfaction and clinical observations to measure quality of care in rural health facilities in Tanzania. They found that patient satisfaction was correlated with the quality of care based on clinical observations [29]. They did not formally assess process or structural quality. Friedberg M.W et al, 2009 found that structural capacity was correlated with some measures of quality for diabetes but not depressions [30]. Recently Das J et al, 2012 used unannounced standardised patients to measure quality of care in rural and urban India. They found that structural quality such as infrastructure and availability of equipment did not correlate with quality of care and some technical quality measures such as training were weakly correlated with quality of care.

Table 7. Linear regression analysis of the association between the different measures of quality of care.

	Model 1:Dependent variable: Children clinical observation score			Model 2:Dependent variable: Adult clinical observation score			Model 3:Dependent variable: Children satisfaction score			Model 4:Dependent variable: Adult satisfaction score			Model 5:Dependent variable: Adult service coverage score			Model 6:Dependent variable: Children service coverage score		
Variable	coeff	Std err	P	coeff	Std err	P	coeff	Std err	P	coeff	Std err	P	coeff	Std err	P	coeff	Std err	P
(Constant)		129.8	.07		143.03	.93		46.47	.72		32.74	.14		35.20	.08		67.24	.72
Infrastructure Score	2.14	5.45	.49	.22	5.48	.27	.12	1.77	.55	2.27	1.27	.21	2.00	1.35	.95	.37	2.58	.13
Service readiness Score	.44	1.56	.06	.54	1.56	*.03	2.38	.48	.08	2.02	.37	.94	.25	.39	.30	2.16	.74	.56
Basic Equipment Score	2.21	5.45	.44	2.49	5.29	.08	.12	1.71	.63	.14	1.26	.64	.40	1.30	.15	2.39	2.49	.22
Drug availability Score	2.40	5.08	*.02	.00	5.73	.99	2.09	1.86	.64	.09	1.36	.65	2.07	1.41	.34	.09	2.69	.67
Infection Control Score	.03	5.58	.88	.18	5.59	.34	.23	1.77	.20	2.12	1.33	.54	2.25	1.38	.10	.03	2.63	.82
Governance score	2.06	.66	.77	2.14	.67	.48	.35	.20	*.05	2.21	.157	.32	2.08	.17	.70	.02	.32	.92
Training	.06	.24	.71	.23	.23	.17	.11	.08	.49	2.03	.05	.86	2.24	.06	.16	2.05	.12	.79
Peri Urban	.05	14.55	.73	.12	14.81	.45	.20	4.68	.22	2.12	3.51	.50	.18	3.65	.30	2.15	6.96	.44
Hospital	.18	28.36	.28	.04	31.04	.84	.13	10.01	.48	.01	7.42	.99	2.05	7.64	.82	.11	14.59	.61
Chongwe district	2.43	15.99	*.05	.26	17.06	.29	.32	5.36	.18	2.12	4.06	.64	2.38	4.20	.13	2.01	8.02	.97
Luangwa District	2.03	16.74	.85	2.08	17.80	.68	2.02	5.80	.99	.26	4.15	.26	.32	4.38	.10	2.07	8.37	.76
Motivation score	.05	1.36	.79	2.40	1.33	*.03	.09	.43	.60	.24	.31	.22	.01	.33	.98	2.02	.63	.91
Adult clinical observation score	2.12	.18	.52	-	-	-	.12	.51	.15	.18	1.22	.62	.31	.13	.19	.13	3.33	.76
Children clinical observation score	-	-	-	.45	2.23	.24	2.13	.06	.50	2.02	.05	.92	2.10	.05	.62	2.04	.09	.87
Children satisfaction score	2.11	.59	.56	.041	.60	.84	-	-	-	.35	.14	.11	.18	.15	.39	.23	.28	.34
Adult satisfaction score	.023	.87	.89	.381	.82	*.04	.43	1.32	.22	.28	1.22	.67	2.10	.20	.57	.09	.39	.68
Finance score	0.93	20	.77	.315	.21	.08	.07	1.17	.70	.76	2.36	0.76	.27	4.41	.19	.41	.17	.88

*P,0.05.

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Based on baseline results, our study suggests that both structural and technical capacities could be important for quality improvement and that children and adults measures of quality were sensitive to different measures of process and capacity. In our regression model, we used several dependent outcome variables such as coverage of some essential services in the community, patient clinical observations and service satisfaction and related these to some structural and process capacity indicators. The results were conflicting and highlighted the need for more evidence [28].

The study had a number of limitations which could affect the results of our study. The data was dependent on verbal responses which are prone to information bias [31,32]. The fact that the respondents were working for the Ministry of Health at the time of interview could have affected the responses with most of the health workers fearing to give a bad image of their institutions for fear of victimisation. This being a cross-section study, it was not possible to attribute the cause and effect among the various domains. Clinical observations have an inherent weakness where those under observation change their usual behaviour thereby giving a false impression about service quality [33].

The balanced scorecard has been criticised as lacking clear focus and promoting multiple goals that might be difficult to reconcile. For example, most balanced scorecard tend to give equal weights to all domains when in reality some domains could be more important than others [34]. In our study, we attempted to give more weight to the clinical observations as this was seen as the most appropriate proxy of quality of care which is the main aim of the study, at least in the short term. Interestingly, there was no correlation between clinical observations and most elements of balanced scorecard. This raises the question of whether the balanced scorecard indicators and domains applied in this study were appropriate and whether the use of the balanced scorecard was serving the intended purpose in our context. We hope to address some of these issues in our follow up study when we compare control and intervention sites. In addition, we will triangulate our data collection to include qualitative methodologies in order to capture some of the important contextual factors and processes that may not be observable in a balanced scorecard.

Conclusion

The study applied the baseline balanced scorecard to rank the performance of 42 health facilities in three districts of rural Zambia. Differences were noted by district and residence in most domains with finance and service delivery domains performing poorly in all study districts. Despite some limitations, this tool is a useful approach to monitoring health systems intervention in low-income settings and may be valuable in achieving targets towards the health-related Millennium Development Goals.

Author Contributions

Conceived and designed the experiments: WM PGF MTM NK NC DB NS HA. Performed the experiments: WM MTM NC HA. Analyzed the data: WM MTM HA. Contributed reagents/materials/analysis tools: WM NC MTM HA. Wrote the paper: WM PGF MTM NK NC DB NS HA.

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CHAPTER 7:

7. BASELINE QUALITATIVE STUDY: SYSTEMS THINKING IN PRACTICE

7.2. Research paper 5:

For research paper already published:

Title: ***Systems thinking in Practice:*** **The current status of the Six WHO building blocks for Health System Strengthening in three BHOMA intervention districts of Zambia:** ***A baseline qualitative study*** **Submitted to** ***Health Services Research and Policy (BMC)***

Where was the work published: BMC Health Services Research

When was the work published: **June, 2013**

If the work was published prior to registration for your research degree, give a brief justification for its inclusion: **None applicable**

Was the work peer reviewed: **Yes**

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I was a lead researcher on health system evaluation on the BHOMA project. Designed the study tools and took part in data collection. I coded all the qualitative and drafted the manuscript and was the lead author.

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Systems thinking in practice: the current status of the six WHO building blocks for health system strengthening in three BHOMA intervention districts of Zambia: a baseline qualitative study

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Abstract

Background: The primary bottleneck to achieving the MDGs in low-income countries is health systems that are too fragile to deliver the volume and quality of services to those in need. Strong and effective health systems are increasingly considered a prerequisite to reducing the disease burden and to achieving the health MDGs. Zambia is one of the countries that are lagging behind in achieving millennium development targets. Several barriers have been identified as hindering the progress towards health related millennium development goals. Designing an intervention that addresses these barriers was crucial and so the Better Health Outcomes through Mentorship (BHOMA) project was designed to address the challenges in the Zambia's MOH using a system wide approach. We applied systems thinking approach to describe the baseline status of the Six WHO building blocks for health system strengthening.

Methods: A qualitative study was conducted looking at the status of the Six WHO building blocks for health systems strengthening in three BHOMA districts. We conducted Focus group discussions with community members and In-depth Interviews with key informants. Data was analyzed using Nvivo version 9.

Results: The study showed that building block specific weaknesses had cross cutting effect in other health system building blocks which is an essential element of systems thinking. Challenges noted in service delivery were linked to human resources, medical supplies, information flow, governance and finance building blocks either directly or indirectly. Several barriers were identified as hindering access to health services by the local communities. These included supply side barriers: Shortage of qualified health workers, bad staff attitude, poor relationships between community and health staff, long waiting time, confidentiality and the gender of health workers. Demand side barriers: Long distance to health facility, cost of transport and cultural practices. Participating communities seemed to lack the capacity to hold health workers accountable for the drugs and services.

Conclusion: The study has shown that building block specific weaknesses had cross cutting effect in other health system building blocks. These linkages emphasised the need to use system wide approaches in assessing the performance of health system strengthening interventions.

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Background

In the year 2000, the United Nations millennium declaration was signed by 189 member countries. These were later translated into eight millennium development goals (MDGs) which were to form a basis for development and poverty eradication throughout the world. Out of the eight MDGs, three are directly related to improve- ment of health [1,2].

The drive to produce results for the MDGs has led many stakeholders to focus on their disease priority first. However, recent evidence has lead to concerns that many member countries especially in poorer nations will be unable to meet the MDG targets by the year 2015 [1,3]. Experience to date, suggests that if health systems are lacking capabilities in key areas such as the health workforce, drug supply, health financing, and information systems, they may not be able to respond adequately even if there was an increased in funding and technical support. Furthermore, there is concern that already weak systems may be further compromised by over-concentrating resources in specific programmes, leaving many other areas further under-resourced [3,4]. It has now been recognised that a primary bottleneck to achieving the MDGs in low-income countries is health systems that are too fragile and fragmented to deliver the volume and quality of services to those in need [3,4]. Strong and effective health systems are increasingly considered a prerequisite to reducing the disease burden and to achieving the health MDGs, rather than the out- come of increased investments in disease control. As a consequence, health systems strengthening (HSS) has risen to the top of the health development agenda.

In order to justify continued investments in health systems, there is need to generate evidence that such investment lead to improvement in health [5]. Hence, the design and evaluation of health system strengthening interventions need to be rigorous and robust [6]. In this regard, WHO has proposed a framework of health system building blocks that describes six sub-systems of overall health system architecture. The building block approach could help in identifying bottlenecks in the health system and guide efforts in resource allocation and performance evaluation [7]. Anticipating how an intervention might flow through, react with, and im- pinge on these sub-systems is crucial and forms the opportunity to apply systems thinking in a constructive way in health system strengthening [8,9].

In recent times, public health researchers and practitioners have been turning to systems thinking to tackle complex health problems and risk factors. Recent projects have used systems thinking to address specific public health problems like tobacco consumption, obesity and tuberculosis [10-12]. In its recent report, WHO has noted that systems thinking has huge and untapped potential in addressing broader health systems problems [8]. It has been argued that application of systems thinking could help in identifying leverage points in a complex health system and could be valuable in guiding the design and evaluation of public health interventions [13,14].

Zambia is one of the countries that are lagging behind in achieving millennium development targets. Several barriers have been identified as hindering the progress towards health related millennium development goals. These include socio-cultural practices, poor referral systems, limited health infrastructure and lack of qualified health human resources [15]. These barriers limit access to health services especially in rural areas. Designing an intervention that addresses these barriers was crucial. The Better Health Outcomes through Mentoring and Assessment (BHOMA) project was born with the current challenges in the Zambia's MOH in mind and the need to provide a system wide solution rather than disease specific. The BHOMA project was designed to work at district, community and health facility level in the target districts. The full methodology of the BHOMA study is described elsewhere [16].In this paper, we applied systems thinking approach to describe the baseline status of the six WHO building blocks. The main objective was to provide a baseline qualitative ana- lysis of the status of the health systems building blocks before the implementation of the BHOMA intervention in the target districts. This qualitative paper complements baseline quantitative results reported elsewhere [17].

Methods

We used qualitative ethnographic methods to analyse the status of the Six WHO building blocks in three BHOMA districts using systems thinking approach. The three districts were purposefully sampled to act as pilot districts for an innovative health system intervention with the aim of learning and rolling out the intervention to others districts. The other selection criteria were that these must be rural districts and have similar health system challenges to other rural districts in Zambia. The study was conducted between January and March 2011.We conducted key informant interviews and focus group discussions.

Target groups

Focus group discussions (FGDs)

Men aged between 18–35 years

Women aged between 18–35 years, with at least one child or more

Key Informant Interviews

Facility level

The In-charge at health facility

Neighbourhood health committee Chairperson or representative

Pharmacist

District Level

Clinical care specialist

District Director of health

Sampling and size

A total of three districts and nine health facilities were included in the study. Three health facilities were selected in each district. The selection criteria were that in each district one rural, one semirural and one urban health facility was to be included. Where there was more than one eligible health facility one was randomly selected.

At each facility, the health centre in-charge, Chairperson of the Neighbourhood health committee (NHC) and a pharmacist were interviewed.

Around the catchment area of each health facility, two Focus Group Discussions (FGDs) were held with men and women. In total 30 key informant and 18 FGDs were conducted.

Selection for FGD participants

Community groups were organized with the help of local leaders and community health representatives who helped in informing community members about the dates and time of the interview. Attention was paid to the group heterogeneous characteristics, i.e. different oc- cupations, social networks, educational status. Men and women were interviewed separately.

All group discussions were held away from the health facility to avoid influence from the health workers .All interviews were recorded and later transcribed by trained research assistants familiar with qualitative methods. The transcribed material was validated by the team leader.

Data collection

Three different interview guides were used for data collection. Two separate key informant interview guides targeting health workers and community representatives and one Focus group discussions guide for collecting information from community members were developed. The themes and questions were based on literature and reported challenges in the Zambian health system. The questions were pre-tested in pilot health facilities within the BHOMA intervention and adapted to reflect the Zambian health care settings. Focus group discussion guides were translated into local languages spoken in study sites. Key informant interviews were conducted in English except those for community representatives. Questions covered the six building blocks for health system from both demand and supply side:

- Service delivery: Access and barriers to health services.
- Health human resources: Availability, gender and attitude of health workers.
- Medical supplies: Availability and stock out of selected medical supplies.
- Governance: Accountability and community participation.
- Health information: Information flow from health facility to the community.
- Finance: User fees and indirect payments,

Data was collected by the research team comprising the main researcher and three research assistants trained in qualitative methods.

Data analysis

Data was transcribed by five research assistants trained in qualitative methods. All scripts were checked and validated by the main researcher. Transcripts were cleaned and exported to Nvivo 9 for analysis. Coding was done by the main researcher and checked by the second researcher experienced with qualitative methods. Data coding followed pre-determined themes based on health system building blocks. These formed the basis for broader themes which were further subcategorised to increase the explanation ability of the data.

Ethical consideration

The study was approved by the University of Zambia Biomedical Ethics Committee and London School of Hygiene and Tropical Medicine. All participants were informed about the study and signed a consent form before being enrolled in the study. Confidentiality was maintained throughout data collection, analysis and publication.

Results

Health service delivery building block

Barriers to accessing health services

Several barriers were identified as hindering access to health services by the local communities. These included supply side barriers: Shortage of qualified health workers, bad staff attitude, poor relationships between community and health staff, long waiting time, confidentiality and the gender of health workers. Demand side barriers: Long distance to health facility, cost of transport and cultural practices.

Staffing, attitude and waiting time

The staffing levels at health facilities appeared to have a bearing on the patient/provider relationship. It appeared that it was not possible to improve the relationship between the community and the health facility by simply increasing the number of health workers disregarding the issues of behaviour and attitude of health workers. Most members of the community were discouraged from seeking medical attention if the health workers were rude and uncaring. Some community members

only came to seek services if the right health workers were on duty. While most health workers blamed the bad relationship between the community and health workers on fewer numbers of health workers, the com- munity members felt that it was not enough to have more health workers. They insisted that the health workers must be caring and have a positive attitude to- wards work. Waiting time before being seen by a health worker was one indicator of not only the low number of health workers but also a reflection of bad working prac- tices and attitude by health workers. The long waiting hours were a recipe for poor relationship and this was self-reinforcing:

> "*Staffing should be improved at the clinic. If the clinic has adequate staff when patients come they will spend less time at the clinic.*"
> *Male FGD participant, Chongwe*

Community attitude

Community members have a duty to help health workers to perform their duty without risking their lives. Therefore, the issue of improving relationships at health centres has both demand and supply side. Findings from our study showed that the community does not seem to see their responsibility to be crucial in improving relationships with health workers. Community members expected health workers to improve their attitude and not the community needing to change to accommodate health workers. Sometimes the community delayed in seeking medical help until the case was very serious. This was seen as bad community practice that needed to change. However, the community blamed the delays on health workers who they said were unwilling to attend to none serious cases, so community members had no choice but to wait until the illness was very serious in order to draw attention from health workers.

> "*You see, other people stay far away from the clinic and have no money for transport.*
> *This makes them to delay in seeking health care until the illness becomes very serious.*"
> *Male NHC chairman, Luangwa*

Inequalities in access to health services

Access to health services is vital for all age groups and gender. In our study area, services seemed to favour women and children. Participants reported that men were usually bottom on the list when it came to receiv- ing help from health services from the health facility. This was reflected in the following quote:

> "*In most cases when children have got problems they are given medication including injections.*
> *Adults are usually told that drugs are out of stock so they have to buy on their own.*"
> *Male FDG participant, Kafue*

Confidentiality

Stigma remained a challenge in accessing HIV and sexually transmitted diseases services. Many clients feared that health workers could breach confidentiality if they were told about such sensitive matters. In contrast, NHC members believed that health workers maintained confidentiality at all times. One such service negatively affected by stigma was couple counselling for HIV which has remained low.

> "*Sometimes patients are not free to talk to health workers, for example they may have an STD but it may be difficult for them to explain to the health workers until the condition becomes very bad. In some cases, patients have died at home that is when people discover that they were suffering from this and that disease.*"
> *Male, FDG participant, Luangwa*

Distance and transport costs

Long distance from health facilities and cost associated with transporting patients to local health facilities and referral centres were the major demand side barriers to accessing health services on time. There was limited access to ambulance services in most rural health facilities and in some cases patients referred to hospital were asked to arrange their own transport. This resulted in some referred patients staying and dying at home because they could not afford transport costs. In fact services rated very poorly in most health centres were those needing referral to other institutions to complete the management of illness.

> "*Sometimes when the patient is very sick they are unable to sit on a bicycle and are unable to walk so you find that it would even take time for them to come and reach the health services.*"
> *HC, in-charge, Kafue*

> "*For T.B, we still have problems in the sense that for us to know that a person has T.B, when they get sputum they have to take it to a bigger hospital for laboratory testing after testing if they find T.B that is when they come here to receive T.B drugs.*"
> *HC in-charge, Chongwe*

Health human resources building block

Shortage of health human resource

The density of qualified human resources has been found to be important in improving the quality of health services. In the absence of trained health workers service delivery could be severely compromised [18,19]. In our study we found that there was a general shortage of qua-

lified human resources such that patients were sometimes attended to by cleaners and other untrained staff.

> "*The health workers are not enough sometimes. When you have a patient you take him to the clinic and if the nurse is not around, then you are attended to by the cleaner who is not trained to do that job so we need more nurses.*"
> *Male FDG participant, Luangwa*

Task shifting: are the unpaid daily employees (CDEs) the answer?

In recent times, there has been an increased emphasis on task shifting as a solution to the problem of staff shortages for qualified health workers. This has taken different forms in many countries with some volunteers or paid lay workers taking up some roles originally done by qualified health workers [20-23]. In Zambia, a cadre known as Classified Daily Employees (CDEs) are helping health workers to perform some tasks which they have never been trained to do. Though some of them have now been put on government payroll, most of them work on voluntary basis and perform tasks ranging from patient screening to prescribing and despising drugs.

The findings showed that, although CDEs were seemingly willing to help at the health centre, they appeared to have deep seated bitterness for not being paid despite their contribution. Though most of them accepted that their work was supposed to be voluntary, after working for some time, they generally felt entitled to remuneration and indirectly showed signs of demanding payments for their work. They contended that they were overwhelmed with responsibilities and required to work awkward hours just like trained health workers yet without pay. There was a feeling of abuse and helplessness among many CDEs.

> "*According to me we still have so many problems because even as I am here we are not paid. You see because of the job I do here, I am unable to do other jobs which can give me money, but instead I help the people (staff) who are paid by the government so that is a big problem for me.*"
> *Male CDE, Luangwa*

Suggested motivation for CDES

Although some CDEs are currently working on voluntary basis, they were keen to receive incentives as a motivation as well as a sign that their work was being appreciated. Though money was seen as important, other forms of motivation highlighted during the study were less complicated than initially thought. These included positive complements, simple certification, training opportunities and being given priority when new research projects are being implemented in the area.

Gender and age of health workers and health facility delivery

The gender of health workers can positively or negative affect access to health services. The type of health services likely to be affected may differ by area of residence and cultural beliefs. In our study male nurses were seen as a hindrance to health facility deliveries as many women expressed reservations to being attended to by male nurses during labour. This could be a cultural issue which is more pronounced in rural areas than urban. For example in one rural health facility in Kafue district, there was only a male nurse attending to patients includ- ing pregnant women. He acknowledged that some women were not happy to give birth at the health centre because it was manned by a male health worker and so they preferred to give birth at home or other facilities were female workers were present. This finding was confirmed through interviews with women and men in the community.

> "*You know we only have a male nurse here, we need a female nurse. Because of this problem other women give birth from home or go to nearby hospital.*"
> *Female FDG participant, Chongwe*

Younger health workers discouraged older clients from seeking health care as explained by one respondent:

> "*Some people fail to come to the clinic because of the age of the health workers for instance some are young as a result those who are older than them fail to come to the clinic.*"
> *Male FDG participant, Chongwe*

Medical and drug supplies building block

Managers' and community perception of drug availability

The health facility in-charges' perception of drug availability was interestingly different from the community members who felt that the drugs were not always available. Most health facilities experienced shortages of essential drugs. This was attributed to irregular supplies of drugs by the government.

Interestingly, whether drugs were in stock or not revealed important insights that must be considered when planning for drugs and other medical supplies.

Some drugs were in stock because there were few cases to be treated not because there was a good supply. Other drugs run out because there was higher demand compared to supply. Some health facilities had high population but the drug supplied seemed to be fixed.

This was reported in bigger health facilities located in peri urban areas as expressed by one respondent:

> "*The population is big and the drugs the government send us are not enough.*"
> *Female FDG participant, Chongwe*

Some drugs run out of stock because they were more used than others. In some cases community demanded to be given certain drugs as they felt these were most helpful. For example, there seemed to be a belief among most community members that flagyl (an antibiotic) was good medicine for diarrheoa and if not given some members of the community felt betrayed. In such instances, some health workers felt obliged to give such medication even when they knew that would not change the course of the illness. This was done for the sake of maintaining confidence and trust in the health services being provided at health facility.

When some medicines run of stock, patients were given prescriptions to buy from private pharmacies. Most clients were not happy to be given prescriptions as they had no money to buy drugs from private pharmacies.

> "*Sometimes when you go to the clinic they just give you a prescription for you to go and buy medicine.If we can't afford to buy books, how can we afford to buy medicines from private pharmacies?*"
> *Female FDG participant, Luangwa*

Governance at health facility level

Health system governance has many facets. Some elements of governance include transparency, accountability and community participation [24]. We collected information about some elements of governance from both facility managers and community perspectives.

Community participation in health services

There were gender differences in community participation in health service provision. Male community members were more likely to participate in health facility initiatives and were well informed about services available at the health facilities and took part in the activities of the health facility. In contrast, most female participants were not aware of the activities that were going on at the clinic. However, when asked about who owned the health services at health facility, most respondents including women said that the health services were owned by the community despite their low participation.

Accountability for the resources

It is crucial that members of the community provide checks to health workers to ensure equitable access to health service. The capacity for community to hold health workers accountable vary from community to community and area of residence (rural vs. urban) [25]. In Zambia the Ministry of health has recommended formation of neighbourhood health committees as part of the governance structure for a health facility. These are expected to act as representatives and eyes for the community [26]. We explored the extent to which the communities or their representatives held the health workers accountable for resources especially drugs.

The results showed that, community members including members of NHC assumed that the nurses and clinical officers accounted for the drugs and did not actively ensure that this was done and appeared quite ignorant of the process of accounting for the available drugs and medicines.

The community seemed to be incapable of holding health workers accountable for the drugs and services as in most cases they didn't know how the health workers did their work and so could not ask intelligent questions as highlighted by one NHC committee member:

> "*The workers at the clinic are the ones who see to it that the medicines are given to every patient us from the community we don't know.*"
> *NHC chairman, Luangwa*

Finance building block: indirect payments

The Zambian government has abolished user fees in rural areas to protect patients and their families from catastrophic health expenditures [27]. This policy has been adopted and is said to be working in most health centres throughout Zambia. In this study we wanted to confirm whether health facilities were indeed not char- ging patients for services received. The result showed that although most of the selected health facilities indi- cated that they did not charge user fees to patients or clients, in reality there seemed to be indirect payments through forcing clients to buy books from health facil- ities or shops. Those without books were not being attended to by health workers at health facilities. This was seen as a form of payment by most community members who felt discouraged from seeking medical at- tention even when they were very sick because they could not afford to by a note book. One respondent said:

> "*We don't pay user fees, it is for free. But we are told to buy books from the clinic once we buy from somewhere else they refuse to write in them.*"
> *Female FDG participant, Chongwe*

User fees were officially requested for patients crossing from Mozambique into Zambia seeking medical attention in Luangwa district. This was not the case in

Chiawa (Kafue) were Zimbabweans seeking health services in Zambia did not pay any form of user fees.

Health information

Information flow from the health centre to the community about new services was very inconsistent and appeared to depend on community volunteers. While most health workers assumed that the NHC communicated information to the community, there was no way of verifying this. Most community members denied being aware of new services or initiatives that were being implemented by the health facility. Interesting health information flow appeared to favour males who acquired information through their local social networks more than female respondents.

> "*The villagers do not know or are not aware of all the programmes offered by the clinic as some of them in most cases have to ask if certain services are offered by the clinic.*"
> *Female CDE, Luangwa*

Discussion

The study has shown that building block specific weaknesses had cross cutting effect in other health system building blocks which is an essential element of systems thinking [28]. These linkages emphasis the need to use system wide approaches in assessing the performance of health system interventions [8]. It was clear that challenges noted in service delivery were linked to human resources, medical supplies, information flow, governance and finance building blocks either directly or indirectly.

Service delivery was directly affected by availability of trained health workers. In addition, the attitude and gender of health workers were other key human resource attributes that affected access to health services.

While the concentration of health workers was important, their behaviour and attitude toward patients was even more important to the community. Bad health worker attitude discouraged some people from going to health facility and was cited as a reason for long waiting time at health centres rather than the lack of human resources. Other studies have reported similar concerns about the attitude of health workers and how it has an influence on service utilisation [29].

The gender of health workers was an important consideration when it came to health facility deliveries. Most female participants were reluctant to deliver at the health centre if the only health worker available was male. In such cases, clients preferred to deliver at home or being assisted by traditional birth attendant. The refusal by most women and their partners to be attended to by a male health worker during labour was common in rural health facilities where it was seen to be culturally inappropriate to be attended by the opposite sex during labour. This finding has implication when it comes to attainment of millennium development goals on maternal and child health [1,30].

Another factor noted as a hindrance to accessing HIV and STI services was perceived lack of confidentiality on the part of health workers. Most community members feared that health workers would leak information about their HIV or STI status if they went to the nearby health facility. This resulted in delays in seeking medical attention with associated complications. The fear of brea- ching confidentiality has been reported in Zambia even among health workers when they come to seek HIV ser- vices [31]. It is important that health workers are trusted by community to keep confidential information. If patients are assured of confidentiality, they are more likely to seek medical attention early at the nearest health centre [32].

In few places, there were no qualified health workers and such health facilities were being manned by unqualified personnel known as Classified Daily Employees (CDEs). Similar findings have been reported in other districts within Zambia [33]. These usually worked on voluntary basis. The study findings showed that they had no formal training or evaluation. With most health facilities having only one trained health worker, in the absence of trained health, the responsibility fell on CDEs. This puts the patient's lives at risk and severely compromised quality of service delivery [22]. While most of them were doing their best to help on voluntary basis, the indications were that this was not sustainable. Most CDE wanted to be trained and to receive allowances and other incentives which were not currently available. While task shifing has been noted to be successful elsewhere, its success has depended on training of lay workers to do specific tasks and not necessarily managing patients on their own as this responsibility falls on qualified health workers [20,34,35].

There was a general feeling by the community that essential medical supplies were usually out of stock. Rapid diagnostic tests for malaria (RDT) and antibiotics were said to be out of stock most of the time. This had negatively affected trust in the health system as most participants felt cheated when they were only given prescription to buy medications which were not in stock. The reason for stock out was that supply of medicines was fixed while the demand had kept increasing. It was not possible to know whether health workers misused the medical supplies as the community and its representatives lacked capacity to hold health workers accountable for medical supplies. They simply trusted that health workers were doing a good job.

Access to health services had been declared free in Zambia following removal user fees [27]. This was reported to be

the case in all health centres except a few places in Luangwa where user fees were charged to foreigners seeking health care in Zambia. Nonetheless, there was a requirement that patient provided their own note book for medical notes. This condition was seen by many as a form of payment and was discouraging some people from seeking medical attention.

Another barrier to accessing health services was long distance to health facilities which translated into high transport for patients and their families [36]. The lack of ambulance compounded the problem as most clients were required to facilitate and pay for their own trans- port and lodging to referral centres. It was therefore not surprising to find that most services needing referral were among the worst performing.

Conclusion

In summary, there were close linkages between service delivery and other health systems building blocks. Challenges affecting particular building blocks seemed to have ramification in other building blocks directly or indirectly. For example, the attitude, behaviour, gender and age of health workers seemed to have an effect on trust and demand for health services. It is therefore es- sential to apply system wide approaches when evaluating health systems due to close linkages that exist between subsystems. It was clear that the success or failure reported in one building block accounted for success or failure reported in other building blocks.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

WM: Participated in study design, data collection and analyzed the data and drafted the manuscript. VB: Participated in study design and provided critical review of the manuscript. MTM: Was involved in designing the BHOMA project and reviewed the manuscript. SM: Participated in data collection and analysis and reviewed the manuscript. DB: Provided critical review of the manuscript from a health systems perspective. NS: Provided critical review of the manuscript from a health policy perspective. HA: Designed the BHOMA project and provided critical review of the manuscript. All authors read and approved the final manuscript.

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CHAPTER 8:

8. FOLLOW UP STUDY: BALANCED SCORECARD TO MEASURE THE IMPACT OF BHOMA:

8.2. Research paper 6:

For a research paper prepared for publication**:**

Title:

Application of Balanced Scorecard in the evaluation of a complex health system intervention: 12 months post intervention findings from the BHOMA Intervention: A cluster randomised trial in Zambia

Where is the paper intended to be published: **Plos One**

Stage of publication: **Submitted**

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For multi-authored work give full description of your role in the research and preparation of the paper:

I was a lead researcher on health system evaluation on the BHOMA project. Designed the study tools and took part in data collection. Performed all the data analysis and drafted the manuscript and was the lead author.

Candidate Signature:

_____

Supervisor or senior author's signature to confirm roles as stated:

_____

Title:

Application of Balanced Scorecard in the evaluation of a complex health system intervention: 12 months post intervention findings from the BHOMA intervention:
A cluster randomised trial in Zambia

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Abstract:

Introduction:

In many low income countries, the delivery of quality health services is hampered by health system-wide barriers which are often interlinked, however empirical evidence on how to assess the level and scope of these barriers is scarce. A balanced scorecard is a tool that allows for wider analysis of domains that are deemed important in achieving the overall vision of the health system.

We present the quantitative results of the 12 months follow-up study applying the balanced scorecard approach in the BHOMA intervention with the aim demonstrating the utility of the balanced scorecard in evaluating multiple building blocks in a trial setting.

Methods:

The study is a cluster randomised community trial of the BHOMA intervention that aims to strengthen the health system in three rural districts covering 42 health facilities in Zambia. The study has an integrated package of interventions at district, health facility and community level which aim to improve service quality and demand. It has a stepped wedge design. This paper reports the findings of the follow-up health facility survey that was conducted after 12 months of intervention implementation. At each health facility, health facility managers, health workers and patients were surveyed. Comparisons were made between those facilities in the intervention and control sites. Analysis was stratified by district and time in the intervention. STATA version 12 was used for analysis

Results:

The study found significant mean differences between intervention(I) and control (C) sites in the following domains: Training domain (Mean I:C;87.5.vs 61.1, mean difference 23.3,p=0.031),adult clinical observation domain (mean I:C;73.3 vs.58.0,mean difference 10.9,p=0.02) and health information domain (mean I:C;63.6 vs.56.1,mean difference 6.8,p=0.01. Linear regression showed statistically significant difference in adult clinical observation score between intervention and control sites (coef 23.29, p=0.01).

Conclusion:

This study demonstrates the utility of the balanced scorecard in assessing multiple elements of the health system. Using system wide approaches and triangulating data collection methods seems to be key to successful evaluation of such complex health intervention.

Introduction

In many low income countries, delivery of quality health services is hampered by system wide barriers which are often interlinked and their contribution to outcomes difficult to establish [1,2]. It is therefore important that health managers and researchers recognise this and use methods and approaches which take into account the complexity and connectedness across health system building blocks [1,3,4]. Some researchers have argued that part of the problem with the health systems debate and research is that it tends to adopt a reductionist perspective that ignores the complexity of the health system [5]. There are now calls for paradigm shift in the way interventions are designed and evaluated [1]. Emphasis should be paid not only to outcomes but also to the processes leading to the observed outcomes [1]. It has been recognised that taking a more comprehensive view that expands and challenges the status quo is more likely to provide lessons on what works and why [2,3,6,7]. However, despite these recent advances in thinking around health systems, there are very few cases of studies empirically addressing these complexities in their design and interpretation of findings. A recent systematic review showed that many evaluations of complex interventions are too narrow and lack a system wide approach [7].

An approach such as a balanced scorecard allows for a comprehensive analysis of domains that are deemed important in achieving the overall vision of the health system[8,9]. A balanced scorecard is a strategic management tool that was first suggested by Robert Kaplan and David Norton in 1992 [10]. It provides information on areas of strategic importance to guide future planning, but also serves as a snapshot of how well an organisation or system is performing [11].It is made up of domains and indicators derived from the strategic vision of an organisation aimed at measuring its performance [12,13]

Although the use of balanced scorecard in health care is being advocated, its application has been mostly limited to high income countries [10,13,14,15,16,17]. The World Health Organisation has recently recommended the use of balanced scorecard in monitoring and evaluation of the health system building blocks[18]. Studies that have applied balanced scorecard have given arguments for adopting balanced scorecard approach in evaluating health system interventions and demonstrating that such a methodology has the potential to guide investments aimed at improving health system especially in low income countries [17,18,19,20,21]. The

advantage with using a balanced scorecard is that it enables the focus on the overall vision while looking at the processes which are deemed important in achieving the overall goal [10,12]. Crucially, the balanced scorecard approach provides means for researchers and health system managers to evaluate complex interventions[8].

Edward et al.2011, modified the original balanced scorecard making it more applicable in low income country health care settings. They highlighted six important domains for measuring health system strengthening [19]. Work done in Bangladesh by Khan et al.2012 has highlighted the central role that balance scorecard approaches could play in identifying barriers and facilitators of health system interventions and how data collection guided by balanced scorecard at health facility level could improve decision making[15].In our recent publication, we applied the balanced scorecard approach to describe the baseline status of three BHOMA intervention districts in Zambia[22] . We reported the applicability of the balanced scorecard in the Zambian health care settings and the implication for evaluating health system interventions targeting the Millennium Development Goals[22]. In this paper we extend this work by presenting preliminary findings after 12 months of implementation of the BHOMA intervention. The BHOMA study is a cluster randomised stepped wedge study of interventions aiming to strengthen the health system in three rural districts of Zambia. The evaluation of the BHOMA intervention utilises both qualitative and quantitative approaches. In this paper, we present the quantitative results of the follow-up study applying the balanced scorecard approach as described at baseline [22]. Qualitative results are presented elsewhere[23].

This study seeks to contribute to generation of empirical evidence in health system research by utilising an innovative approach that offers an opportunity to assess multiple domains that exits in complex health systems.

Methodology:

The BHOMA study is a cluster randomised community intervention that aims to strengthen the health system in three rural districts covering 42 health facilities in Zambia with a total population of 306,000.

The study has a stepped wedge design where the intervention is being rolled-out gradually until all the 42 health facilities receive the intervention. The unit of randomisation is the health facility and its catchment population. The study has an integrated package of interventions, at both health facility and community level. The impact of the interventions is being measured through an evaluation of the interventions using selected endpoints including Standardised Mortality Rate in the population less than 60 years and under-five Mortality. The evaluation data is being collected through community and health facility surveys. This paper focuses on the results of the health facility survey conducted in 2012 when 24 clusters were in the intervention phase of the intervention and 18 in the control phase.

Intervention design

The BHOMA intervention is part of the African health initiative which aim to improve population health in five sub Saharan Africa[24]. The intervention commenced in April 2011 when the first set of health facilities received the intervention. All the health facilities are expected to receive the intervention my mid 2013.The final evaluation of the BHOMA intervention will be 2014. In order to ensure objective evaluation, the BHOMA study is made up of two independent teams. The implementation is being done by the Centre for Infectious Diseases Control in Zambia (CIDRZ) while the Zambia AIDS Related Tuberculosis (ZAMBART) is evaluating the project. The teams work closely with each other and the Ministry of Health at national and district level.

The BHOMA intervention is made up of three primary strategies designed to work at different levels of the health system. These are district, health facility and community strategies. The full methodology is described elsewhere [25,26]. Following is a summary description of the three BHOMA strategies:

The district

Each of the three districts has one Quality Improvement (QI) team is which implements the intervention in target health facilities. Each QI team consists of two nurses and one clinical officer. The teams work closely with the Ministry of Health.

The health facility intervention

The health facility-based intervention aims to improve clinical care quality by implementing practical tools that establish clear clinical care standards, providing essential resources to meet these standards and communicating standards through intensive clinic implementations. Each clinic generates self assessment reports that help identify areas of weakness for further improvement with support from the quality improvement team. Leadership training is provided to the health workers targeting governance, finance, supply chain and human resource management. Staffing support consists of lay workers trained as “Clinic Supporters.” These lay workers are trained to assume as many non-clinical duties as possible. These include registration of patients, filing, triaging, recording vital signs, fast tracking urgent cases and routing patients through services.

The community intervention

The BHOMA project has engaged community health workers on part time basis. They are trained in providing preventive services and tracking missed clinic appointments. They work in collaboration with community health units known as Neighbourhood Health Committees (NHCs) and Traditional Birth Attendants (TBAs).The community health workers are also being trained in capturing and recording local health data and sending it to health facilities via mobile phones or physically.

INSERT: ***Figure 1: Summary of the BHOMA intervention cascade***

Figure1 gives a summary of the BHOMA intervention. The community strategy is expected to drive the demand for health services while the health facility strategy is expected to improve health worker skills, service quality and other health system building blocks. The overall effect of the intervention is to improve health outcomes.

Randomisation and rollout plans

There were 48 eligible health facilities in the three BHOMA districts. Six were used for piloting the intervention. The remaining 42 health facilities were randomised in the order of receiving the intervention in a step wedge fashion until all receive the intervention. Six facilities are randomised to start the intervention in each step and each step took three months to implement.

Randomisation was done by a statistician from London School of Hygiene and Tropical Medicine who had no prior knowledge of the study sites. Randomisation was stratified by district.

Evaluation design

Baseline survey

A baseline survey was conducted at the beginning of the intervention in 2011. A balanced scorecard was applied to rank the performance of the 42 target health facilities. The results of the baseline study have been reported elsewhere[22]

Follow-up study:

A 12 months follow-up health facility survey was conducted in 42 health facilities between May and September, 2012. Appointments were made with managers before the research team visited each of the health facilities. At each health facility a number of questionnaires were administered targeting health facility managers, health workers and patients. All the study tools were interviewer administered except for the governance and health worker motivation tools which were self administered. At each health facility the health facility officer in-charge and two other health workers were interviewed. Five observations of adult clinical encounters were done irrespective of the presenting complaint. Five observations of child clinical encounters were done with children being eligible if they were under five years and presenting with fever, cough or diarrhoea. Similarly five exit interviews for adults and five for under five child/guardian pair were done following the same approach described at baseline [22]. For specific tools and calculation of domain scores refer to annexes: 1-7

Data collection was conducted by the evaluating team composed of a team leader who is a medical doctor and epidemiologist, with 18 research assistants with a medical background. Data collectors were trained for five days on how to administer the study tools.

Data analysis

Data were double entered onto an Access database and exported to STATA version 12 for analysis. Simple frequencies were used to explore the data. Comparisons were made between intervention and control facilities stratified by district and the time in the intervention. We looked at effect of the intervention by time in the intervention to determine whether there was dose relationship. Linear regression was done to determine the correlations between measures of quality for children and adults with health system domains in the balanced scorecard[22]. We adjusted for cluster design using Stata version 12 estimation command with the vce(cluster clustvar) option to obtain a robust variance estimate that adjusts for

within-cluster correlation[27].We also adjusted for baseline scores, district and catchment population. Time in the intervention was left out of the model because of collinearity.

Ethical considerations

The study was approved by the University of Zambia Bioethics Committee and the London School of Hygiene and Tropical Medicine Ethics Committee. All participants were informed about the purpose of the survey and were asked to sign a consent form before taking part in the study. Parents/guardians signed consent forms on behalf their children. Those who could not write were asked to thumb print the consent form in the presence of an independent observer. Confidentiality was ensured during data collection and subsequent publication of the results.

Results:

Health facility demographic characteristics

In total there were 42 health facilities which were randomly allocated to the intervention or control. At the time of follow-up, 4 steps of the intervention had been implemented. 24 health facilities were in the intervention phase (I) while 18 had not received the intervention and so were in the control phase (C). For those health facilities that had received the intervention, 12 had been in the intervention phase for between 3-6 months and 12 for between 9-12 months. (See figure 2)

The majority of the health facilities were classified as rural (81% in Chongwe, 71% in Kafue and 57% in Luangwa). Two health facilities were part of mission hospitals (1 in Chongwe and 1 in Luangwa) neither of which had received the intervention. (See Table 1)

Comparisons of intervention and control health facilities

Mean scores were calculated for each domain in the balanced scorecard and these are shown in table 2. The major differences in the mean scores between intervention(I) and control (C) health facilities were in the following domains: Training (mean I:C;87.5.vs 61.1,mean difference 23.3,p=0.031),adult clinical observation (mean I:C;73.3 vs.58.0,mean difference 10.9,p=0.02) and health information (mean I:C;63.6 vs.56.1,mean difference 6.8,p=0.01).These differences were statistically significant before and after adjusting for baseline score, catchment population and district. In addition to the above domains, infection control and tracer drugs showed statistically significant difference after adjusting for baseline score, catchment population and district. (i.e. infection control (mean I:C;86 vs.78, mean difference 9.1,p=0.03), Tracer drugs (mean I:C;80 vs.77, mean difference 3.0,p=0.05). Overall there was no gender difference in adult service satisfaction between control and intervention sites. In addition, governance and motivation scores did not differ between control and intervention sites

District comparison of intervention and control health facilities

In Chongwe district, significant mean differences between intervention and control sites were reported in training domain (I:C;100 vs.66.0.) and health information domain (mean I: C; 66.2 vs. 58.). Higher mean scores in the intervention were also noted in the Basic infrastructure domain (mean I: C; 81.0 vs.73), infection

control domain (mean I: C;89.3 vs.84.1) and adult clinical observations domain (mean I: C; 64.0 vs.53.0).However, the differences were not statistically significant.

In Kafue district, higher mean scores in the intervention were reported in infection control domain I (mean I:C; 82.2 vs.76.2),health information domain (mean I:C; (60.8 vs.55.7) and adult clinical observation domain (mean I:C;80.3 vs.68.5). However, the differences were not statistically significant.

In Luangwa district, significant differences between Intervention and control sites were reported in the training domain (mean I: C; 100 vs.33.3) and infection control domain (82.1vs.61.4,) and adult clinical observation (mean I: C; 68.3 vs.51.1).

Dose dependence effect of the intervention

We compared the effect of the intervention by time in the intervention phase. Possible intervention dose effect was noted in the training domain which showed mean increase from 61.1 in the control to 87.5 when the intervention had been in place for 3-6 months and remained stable after the intervention had been in place for between 9-12 months. The adult clinical observations domain showed a similar trend rising from 58 in the control to 68 at 3-6 months and to 72 at 9-12 months of intervention time. These differences were statistically significant. ($p<0.05$).The domain for Basic equipment showed improvement soon after intervention but deteriorated with time (mean at 3-6 months 78 to 74 at 9-12 months). (See Table 3)

Linear regression model:

Linear regression was done with the following dependent variables: Adult Clinical observation and service satisfaction scores, children clinical observation and service satisfaction scores. In addition to all the health system domains applied at baseline[22], an intervention variable was added to the model. The model was adjusted for baseline scores, catchment population and district. There was no difference in children clinical observation score between the intervention and controls sites. However, children clinical observation was significantly correlated with service readiness (coef 1.2, p=0.01) and health worker motivation (coef 0.44, p=0.09).

There was a statistically significant difference in adult clinical observation score between intervention and control sites (coef 23.29, p=0.01).Other domains which correlated with adult clinical observation were; laboratory capacity (coef 0.25, p=0.04), training (coef 0.16, p=0.07 and health information (coef 0.87, p=0.01).There was no difference in adult satisfaction score between the intervention and control

sites. However, adult satisfaction score was correlated with health information, (coef 0.29, p=0.02, service readiness (coef 0.34, p=0.04), children clinical observation (coef 0.14, p=0.08) and children satisfaction score (Coef 0.23, p=0.07). (See Table 4)

Discussion

This study aimed to apply innovative approaches in evaluating a complex health system intervention and hence contribute to generation of empirical evidence to guide health system strengthening investments[7]. Most of the current discussions in this area are at the level of framework or theory but there is lack of empirical data especially from low income countries [3,28,29]. Applying a system wide approach in the form of balanced scorecard allowed for a comprehensive analysis of the different domains of the health system and how each was affected by the intervention [3,7].

The results showed that the BHOMA intervention led to improvements in some domains of the balanced scorecard while other domains remained unaffected. Significant differences between intervention and control sites were only seen in adult clinical observation, training and health information domains. These differences remained significant when analysis was stratified by district. We acknowledge that these results are still interim as our follow up time ranged only between 3 and 12 months with the last step of health facilities having the intervention for 3 months. Nonetheless, the results point to some positive effect of the BHOMA intervention regardless of the study district, time in the intervention or baseline scores. We will be able to assess the full effect of the BHOMA intervention when the final assessment is made in 2014.

Interestingly, some domains such as health worker motivation, service satisfaction for children and adults and governance did not show differences between intervention and control sites despite the presence of the BHOMA intervention. This remained true even after adjusting for baseline scores and showed no evidence of dose dependence. It remains unclear why these domains did not respond to the intervention but the short observation time could partly explain this. Complex system theory acknowledges delays between cause and effect [30].It will be interesting to see how these domains respond with longer intervention time. Other possible explanations have been explored in the qualitative component of the BHOMA evaluation reported elsewhere[23]

Linear regression analysis showed that adult clinical observation score was one measure of service quality that showed statistically significant differences between control and intervention sites. This might be a more sensitive marker of the effect of the intervention which could be useful when evaluating similar interventions aimed at strengthening complex health systems. Children measures of quality did not show any significant difference between intervention and control even after adjusting for catchment population and baseline scores. We reported at baseline that children measures of quality had lower scores when compared to adults[22]. The current results suggest that child services might still be lagging behind adult services in the BHOMA intervention. This was attributed to low number of health workers being trained in integrated management of childhood illnesses (IMCI) in most study sites. However, we also acknowledge the limitation reported by other studies done in low income settings which have shown that in-service training may not necessarily translate in behaviour change that support quality improvements[31]. This might be the case in some domains that failed to show differences in the presence of the intervention although further follow up is required to confirm this.

Another lesson learnt from the evaluation was that the effect of the intervention needs to be considered with contextual factors [32,33]. These were noted to positively or negatively affect the intervention. In our study, we noted that health facilities located in peri-urban areas with larger catchment population and high patient volume seem to perform poorly in most domains despite the presence of the intervention. Their poor performance generally affected the scores across most domains in the intervention sites as all the bigger health facilities had received the intervention. This observation was important as the effect of the intervention could not be guaranteed by simple randomisation but that context was a critical determinant of how well the site performed in the presence of the intervention Detailed analysis of individual health facilities revealed that hospital based health facilities strongly confounded the mean scores in the control sites as none had received the intervention but still scored very highly in most domains at baseline[22] and follow-up even in the absence of the intervention. In recent times context has been recognised as an important factor that could affect even well designed clinical trials and currently there are efforts to standardise collection of contextual information in clinical trials. Our findings agree with these observations and support

efforts to have contextual data considered in understanding the mechanism of change in trial settings [34,35]

The study had a number of limitations that must be considered when interpreting our findings. Firstly, the study was not powered to look for differences between sites or different types of facilities and therefore we will need to wait for final evaluation before any further interpretation of these findings. Secondly, the time from the implementation to the timing of this interim analysis was relative short. The longest intervention step had received the intervention for 12 months while the last step had received the intervention for three months only. This makes the comparison between control and intervention more complex requiring cautious interpretation. We have tried to explore the effect of the intervention by time or step. However, the results remained inconclusive. It is therefore recommended to see the end line evaluation that includes community survey to make concrete conclusions about the effect of the intervention.

Some study results were based on observation of health workers and how they performed their duties in clinical setting. The fact that they were under observation could alter their usual behaviour positively or negatively depending on what might be desirable [36],hence biasing the results of our study. Similarly, exit interviews with clients could be influenced by this form of information bias[37].

The study was done mainly in rural districts of Zambia were health system challenges might be different from urban settings. Therefore our findings could be more applicable to similar rural settings and may not be generalised to urban settings. In addition, the study sites were fixed and limited to 42 health facilities based on what was available in the selected districts. This resulted in small sample size especially when performing stratified analysis by districts. This was worse in Luangwa district which had 7 health facilities.

Conclusion

This preliminary results show that the balanced scorecard approach can be useful in assessing the effects of complex public health interventions. In evaluation of complex interventions such as the BHOMA attention should be paid to context. Using system wide approaches and triangulating data collection methods seems to be key to successful evaluation of such complex intervention.

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Figure 1:Summary of the BHOMA Intervention cascade

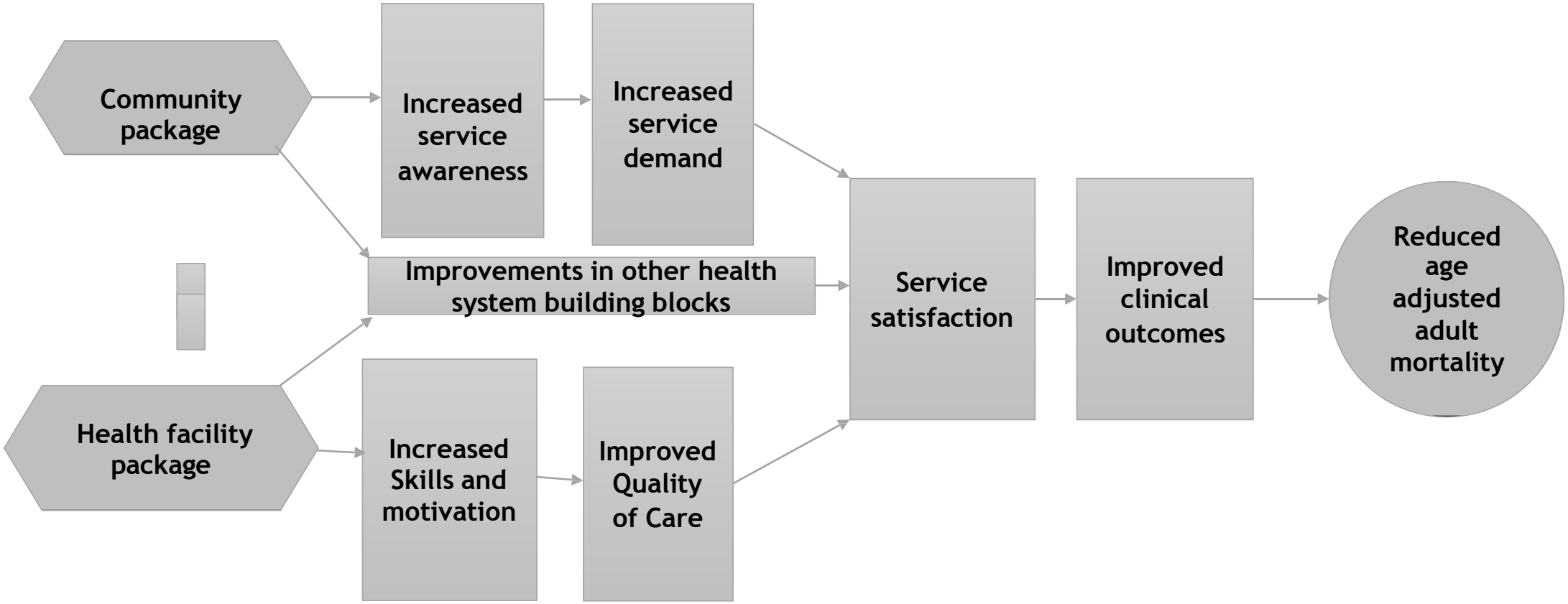
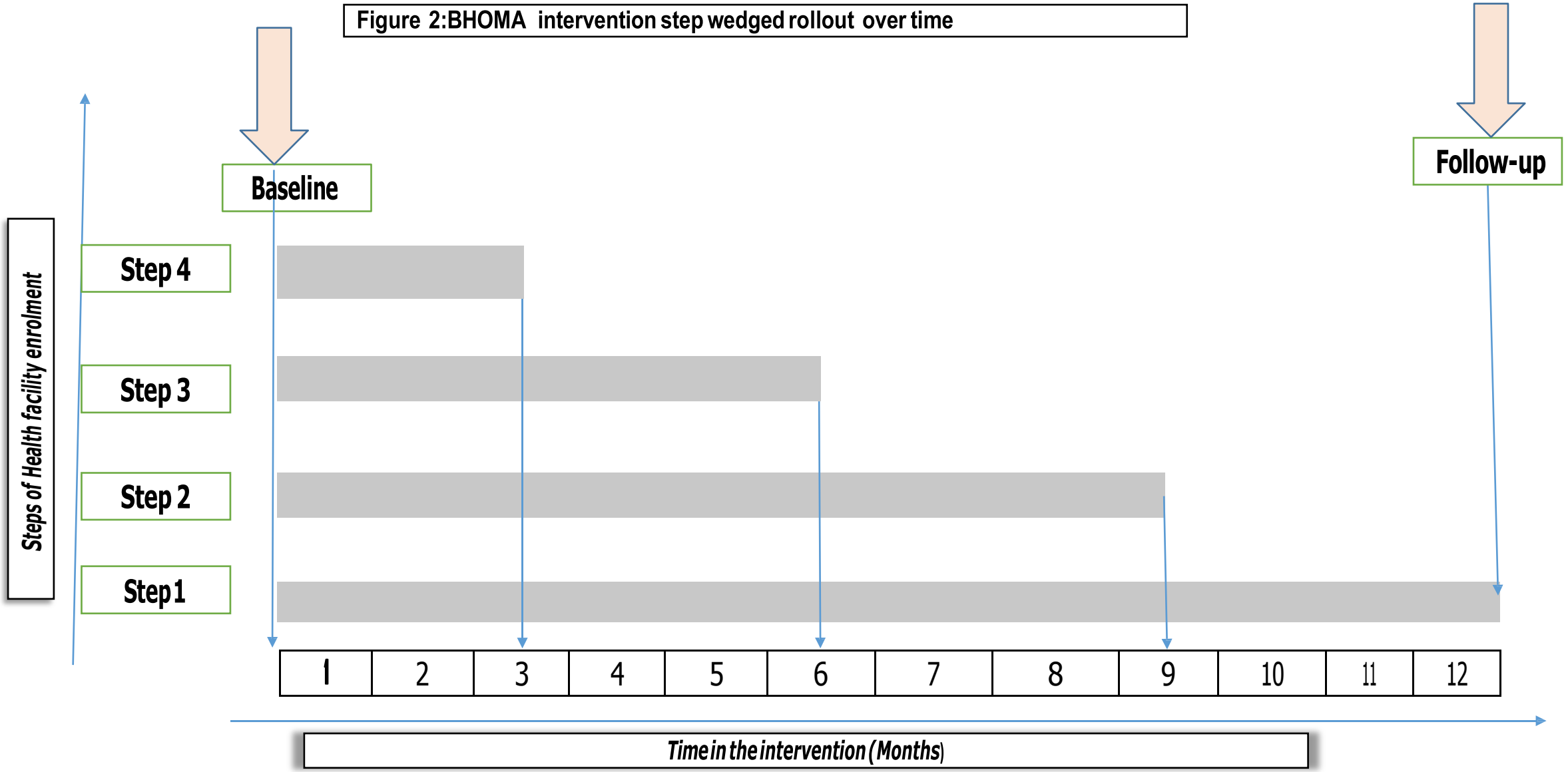


Figure 2:BHOMA intervention step wedged rollout over time



Legend:
Steps refer to the order in which the health facilities received the intervention. Six health facilities received the intervention per step.

Table 1: Summary of health facilities in the intervention and control sites stratified by districts

		Chongwe		Kafue		Luangwa	
	Variable	*n*	*%*	*n*	*%*	*n*	*%*
Allocation:	***Intervention***	12	57.1	8	57.1	4	57.1
	Control	9	42.9	6	42.9	3	42.9
Total		**21**	**100.0**	**14**	**100.0**	**7**	**100.0**
Time intervention:	***0***	9	50.0	6	50.0	3	50.0
	3-6M	6	33.3	4	33.3	2	33.3
	9-12M	6	16.7	4	16.7	2	16.7
Total		**18**	**100**	**14**	**100.0**	**7**	**100.0**
Residence:	***Rural***	17	81.0	10	71.4	4	57.1
	Periurban	3	14.3	4	28.6	2	28.6
	Hospital*	1	4.8	0	0.0	1	14.3
Total		**21**	**100.0**	**14**	**100.0**	**7**	**100.0**

Table 2: Balanced scorecard measure of the effect of the BHOMA intervention after 12 months of implementation stratified by district

:	Chongwe		Kafue		Luangwa		All Districts			
	Intervention(n=12)	*Control (n=9)*	*Intervention(8)*	*Control(6)*	*Intervention (4)*	*Control (3)*	*Intervention(24)*	*Control(18)*	*Mean difference** (95% CI)*	P-value
Domains A: Patients										
Patient satisfaction	69.2 (63.3-74.9)	73.3 (64.5-82.1)	70.7 (66.2-75.0)	69.4 (65.4-73.5)	75.8 (64.4-87.2)	65.6 (57.9-73.1)	70.7 (65.8-75.7)	70.7 (66.9-74.7)	1.4 (-4.5 , 7.3)	0.64
Patient satisfaction	74.8 (68.4-81.1)	82.3 (76.8-87.9)	78.5 (73.7-83.3)	76.7 (72.9-80.4)	72.3 (71.1-73.4)	66.3 (56.7-75.9)	76.0 (71.9-79.3)	77.7 (73.4-82.2)	0.3 -4.0-4.65	0.89
Domain B: Human resources										
Health worker motivation scores	77.0 (71.5-82.4)	79.4 (73.7-85.2)	71.6 (70.5-72.8)	73.8 (66.1-81.6)	83.0 (76.1-89.9)	77.4 (75.7-79.1)	76.3 (72.8-79.7)	77.2 (73.2-81.3)	-1.2 (-6.5-4.13)	0.60
Training domain	**100.0**	**66.7* (34.5-98.8)**	62.5 (38.6-97.7)	66.6 (35.6-97.8)	**100.0**	**33.3* (-22.3-88.9)**	87.5 (76.6-98.4	**61.1* (39.0-83.2)**	**23.3 (2.3-44.5)**	**0.031***
Domain C: Service capacity										
Basic Infrastructure index	80.8 (73.9-87.6)	73.1 (64.5-81.6)	71.6 (60.9-82.3)	76.9 (67.6-86.1)	71.2 (65.3-77.1)	73.1 (69.4-76.8)	76.1 (70.7-81.5)	74.4 (68.9-79.7)	1.9 (-6.2-10.1)	0.63
Basic equipment index	75.8 (64.9-86.7)	87.2 (75.9-98.6)	73.0 (61.6-84.2)	73.3 (61.6-85.1)	82.6 (71.4-93.6)	74.0 (62.9-85.1)	75.8 (68.7-82.9)	80.4 (72.5-88.3)	-5.71 -15.7-4.3)	0.25
Laboratory capacity index	76.1 (69.4-82.8)	70.8 (58.4-83.4)	67.2 (54.3-80.1)	72.9 (57.4-88.5)	65.5 (48.4-82.9)	51.3 (34.6-67.9)	71.4 (64.9-77.9)	68.3 (58.9-77.6)	4.3 (-7.0-15.5)	0.44
Tracer drugs index	88.6 (85.6-91.6)	86.7 (84.2-89.6)	75.6 (72.3-78.8)	74.2 (70.7-77.8)	61.6 (57.3-65.4)	52.8 (50.5-55.2)	**79.7 (75.1-84.4)**	**76.9 (70.8-83.1)**	**3.0 (-0.0-6.1)**	**0.05**
Infection control index	89.3 (83.2-95.4)	84.1 (74.5-93.8)	82.3 (75.3-88.9)	76.2 (63.0-89.4)	82.1 (75.8-88.5)	61.4 (45.9-76.9)	**85.7 (81.5-89.9)**	**77.7 (69.7-85.7)**	**9.1 (0.9-17.2)**	**0.029**
Domain D: Finance										
Finance index	68.0 (60.6-75.5)	70.4 (63.2-77.5)	64.6 (53.4-75.8)	66.7 (66.7-67.6)	58.4 (49.8-66.9)	55.6 (46.3-64.9)	65.3 (59.6-70.9)	66.7 62.1-71.3)	-2.3 (-10.0-5.4)	0.54
Domain E: Governance										
Governance Index	77.3 (69.1-85.5)	81.0 (75.5-86.6)	85.3 (81.8-88.8)	83.3 (73.4-93.2)	87.9 (82.8-92.9)	85.8 (74.3-97.2)	81.7 (77.0-86.5)	82.6 (77.8-87.4)	-0.1 (-7.2-6.9)	0.98
Domain F: Health information										
Health information Index	66.2 (61.0-70.9)	57.8 (54.9-60.7)	60.8 (56.5-64.9)	55.7 (49.3-62.0)	**62.0 (53.6-70.4)**	**56.0* (52.1-59.9)**	**63.6 (60.2-66.9)**	**56.8 (54.1-59.5)**	**7.3 (2.6-12.0)**	**0.003***
Domain E: Service provision										
Service readiness index	68.7 (59.1-70.1)	64.7 (59.1-70.2)	67.8 (62.3-73.2)	75.3 (70.6-80.1)	64.0 (57.9-69.6)	64.7 (62.3-73.2)	67.4 (63.9-70.9)	68.2 (64.1-72.2)	-0.3 (-5.5-4.9)	0.90
Clinical observation index (Children)	82.0 (63.3-99.99.9)	82.2 (59.6-104)	40.9 (22.6-59.2)	50.0 (34.0-65.9))	50.0 (16.1-83.9)	46.7 (17.2-76.1)	62.7 (48.1-77.5)	65.6 (49.9-81.2)	9.6 (-6.6-25.8)	
Clinical observation index (Adults)	63.7 (53.5-73.9)	53.3 (44.0-62.6	80.3 (74.4-86.1)	68.5 (57.3-79.7)	68.3 (63.4-73.2)	51.1 (46.8-55.4)	**70.3 (63.7-76.3)**	**58.0 (51.0-65.0)**	**10.9 (2.13-19.8)**	**0.016***
Domain: Overall vision:										
Service satisfaction index by Gender:										
Male	77.8 (66.7-88.9)	78.2 (72.2-84.2)	75.6 (68.7-82.5)	75.4 (69.1-81.6)	74.0 (69.4-78.6)	73.7 (69.2-78.3)	76.6 (70.3-82.7)	78.6 (72.2-80.6)	-3.3 (-12.4-5.9)	0.47
Female	75.3 (69.1-81.6)	79.3 (75.6-82.9)	74.7 (70.6-78.8)	79.8 (74.5-85.2)	79.1 (71.6-86.6)	77.7 (65.9-89.5)	76.8 (72.0-79.6)	79.4 (72.2-80.6)	-2.7 (-8.3-2.8)	0.32

1. p<0.05 2.**mean difference adjusted for baseline score ,catchment population and district* 1.

Table 3: Balanced scorecard measure of the effect of the BHOMA intervention after 12 months of implementation stratified by timing of roll out

Domain	Time in the intervention		
	Control n=18	3-6 months n=12	9-12 months n=12
Domain A: Patient and community			
Patient satisfaction children index	70.7	69.7	71.8
	(65.7-75.7)	(63.2-76.2)	(67.5-76.1)
Patient satisfaction Adult index	77.7	71.1	80.1
	(73.4-82.2)	(66.1-76.0)	(76.1-84.1)
Domain B: Human resources			
Health worker motivation scores	77.2	75.7	76.8
	(73.2-81.3)	(70.7-80.6)	(72.1-81.6)
Training in the past 12 months	**61.1**	**87.5***	**87.5***
	(39.0-83.2)	**(69.9-105.1)**	**(74.7-100.3)**
Domain C: Service capacity			
Basic Infrastructure index	74.4	78.2	74.0
	(68.9-79.7)	(72.2-84.2)	(65.2-82.9)
Basic equipment index	80.4	80.0	71.7
	(72.5-88.3)	(71.4-88.5)	(60.9-82.5)
Laboratory capacity index	68.2	75.6	67.2
	(58.9-77.6)	(69.6-81.5)	(56.2-78.2)
Tracer drugs index	76.9	80.6	78.8
	(70.8-83.1)	(74.1-87.2)	(72.2-85.4)
Infection control index	77.7	89.3	82.1
	(69.7-85.7)	(84.2-94.3)	(76.1-88.2)
Domain D: Finance			
Finance index	66.6	63.9	66.7
	(62.1-71.3)	(58.4-69.3)	(56.8-76.5)
Domain E: Governance			
Governance Index	82.6	80.4	83.1
	(77.8-87.4)	(74.0-86.8)	(76.2-90.0)
Domain F:Health information			
Health information Index	**56.8***	**63.5***	**63.7***
	(54.1-59.5)	**(58.3-68.7)**	**(59.4-67.9)**
Domain E: Service provision			
Service readiness index	68.2	69.1	65.8
	(64.2-72.2)	(63.2-74.9)	(62.2-69.2)
Clinical observation index (Children)	65.6	66.7	58.9
	(49.8-81.2)	(46.6-86.7)	(37.6-80.2)
Clinical observation index (Adults)	58.0	68.3	71.7
	(51.0-65.0)	(57.4-79.2)	(65.4-77.9)
Domain: Overall vision:			
Service satisfaction index by Gender:			
Male	76.4	73.7	80.0
	(72.2-80.6)	(63.7-83.6)	(75.0-79.4)
Female	79.2	75.9	75.6
	(75.9-82.6)	(72.4-79.4)	(69.4-82.1)

**P <0.05*

Table 4: Linear regression analysis of the association between the different measures of quality of care.

	Model 1: Dependent variable: Children Clinical observation			Model 2 Dependent variable: Adult clinical observation			Model 3: Dependent variable: Children satisfaction score			Model 4: Dependent variable: Adult satisfaction score		
	Coef	**Std err**	**p**	**Coef**	**Std err**	**p**	**Coef**	**Std err**	**p**	**Coef**	**Std err**	**p**
Intervention	7.27	15.32	0.64	**23.29**	**5.09**	**0.01**	6.07	5.85	0.31	3.5	2.7	0.21
Health worker motivation scores	-0.46	0.79	0.56	**0.68**	**0.33**	**0.04**	**0.44**	**0.26**	**0.09**	-0.05	0.16	0.74
Training	0.16	0.13	0.26	**0.16**	**0.07**	**0.02**	0.04	0.05	0.37	-0.01	0.03	0.92
Basic Infrastructure score	0.08	0.29	0.77	-0.03	0.15	0.84	0.13	0.13	0.12	-0.16	0.09	0.09
Basic equipment index	0.08	0.26	0.74	0.16	0.14	0.29	-0.06	0.09	0.51	-0.01	0.08	0.83
Laboratory capacity score	-0.02	0.29	0.95	**0.25**	**0.11**	**0.04**	0.15	0.11	0.16	-0.04	0.06	0.56
Tracer drugs score	1.06	1.10	0.34	-0.18	0.65	0.78	0.18	0.43	0.68	-0.04	0.23	0.86
Infection control score	0.76	0.33	0.03	-0.08	0.19	0.67	-0.09	0.12	0.40	0.05	0.12	0.66
Health information score	0.25	0.61	0.69	**0.87**	**0.31**	**0.01**	0.37	0.22	0.11	**0.29**	**0.11**	**0.02**
Governance score	0.14	0.37	0.70	-0.29	0.35	0.42	0.09	0.15	0.56	0.02	0.10	0.82
Finance score	0.33	0.21	0.95	0.24	0.71	0.62	1.2	0.47	0.78	0.34	0.17	0.76
Service readiness score	**1.21**	**0.41**	**0.01**	0.48	0.31	0.13	0.29	0.20	0.32	**0.34**	**0.18**	**0.04**
Rural residence	-8.49	15.5	0.59	11.5	7.5	0.14	5.20	6.71	0.44	0.28	4.7	0.95
Children Clinical observation score	-	-	-	0.07	0.10	0.52	0.27	0.14	0.21	**0.05**	**0.03**	**0.07**
Adult Clinical observation score	0.08	0.41	0.86	-	-	-	-0.18	0.19	0.38	**0.14**	**0.08**	**0.08**
Children satisfaction score	-0.04	0.43	0.91	-0.29	0.35	0.42	-	-	-	**0.23**	**0.12**	**0.07**
Adult satisfaction score	**1.43**	**0.59**	**0.02**	0.56	0.35	0.11	0.49	0.29	0.10	-	-	-

CHAPTER 9:

9. FOLLOW UP STUDY: SYSTEMS THINKING IN PRACTICE

9.2. Research paper 7

For a research paper prepared for publication:

Title:

Application of systems thinking: 12 months post intervention Evaluation of a complex health system intervention in Zambia: The case of the BHOMA

Where is the paper intended to be published: **Plos One**
Stage of publication: **Submitted**
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For multi-authored work give full description of your role in the research and preparation of the paper:

I was a lead researcher on health system evaluation on the BHOMA project. Designed the study tools and took part in data collection. I coded all the qualitative and drafted the manuscript and was the lead author.

Candidate Signature:

Supervisor or senior author's signature to confirm roles as stated:

Title:

Application of systems thinking: 12 months post intervention Evaluation of a complex health system intervention in Zambia: The case of the BHOMA

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Abstract:

Introduction:

Strong health systems are said to be paramount to achieving effective and equitable health care. WHO has been advocating for using system-wide approaches such as 'systems thinking' to guide intervention design and evaluation. In this paper we report the system-wide effects of a complex health system intervention in Zambia known as Better Health Outcome through Mentorship and Assessment (BHOMA) that aimed to improve service quality. The analysis was guided by a novel evaluation framework based on building blocks for health system strengthening.

Methods:

We conducted a qualitative study in three target districts. In-depth interviews and focus group discussions were used to collect data from key informants and the community. We used a systems thinking conceptual framework to guide the analysis focusing on intended and unintended consequences of the intervention. Nvivo version 10 was used for data analysis

Results:

The community responded positively to the intervention leading to more demand for health services. The indications were that in the short term there was increased demand for services but the health workers capacity was not severely affected. This means that the prediction that service demand would increase with implementation of BHOMA was correct and the workload also increased but the help of clinics' supporters meant that some of the work of clinicians was transferred to lay workers. However, from a systems perspective, unintended consequences also occurred during the implementation of the BHOMA. Several contextual factors seemed to interaction with the project positively or negatively.

Conclusion

We applied an innovative approach to evaluate a complex intervention in low income settings, exploring empirically how the systems thinking can be applied in the context of health system strengthening. Though the intervention had some positive outcomes by employing system-wide approaches we also noted unintended consequences

Background:

Strong health systems are increasingly considered to be paramount to achieving quality and equitable health care[1].There has been an upsurge in investments to improve health systems to address system-wide bottlenecks especially in low income countries[2].This is exemplified by commitments from global health actors such as the G8, global fund,GAVI and PEPFAR who have committed resources to strengthening health systems[3-5].

This renewed zeal and investment in health systems interventions should be matched with equally robust evaluation designs that provide answers with regard to the system-wide effects of health system investments[4,6,7]. Failure to rigorously design and evaluate health interventions will lead to misleading conclusions about the effect of the investments and whether these were worthwhile [8,9]. In recent times, it has been acknowledged that most evaluations are too narrow and fail to capture systems wide effects [8,10]. This is even more important when it comes to complex interventions targeting public health rather than specific well defined services [10,11]. Complex interventions are described as those interventions which contain several interacting components to achieve a common goal.[12,13] Most complex interventions are non linear and unpredictable and tend to be adaptive [11,14]. Evaluation of such complex interventions require paradigm shift in the way research questions are framed and evaluated [15]. Given the increasing use and WHO advocacy for using system-wide approaches such as systems thinking to guide intervention design and evaluation this is an opportune time to produce evidence of what works in evaluating complex systems [8,16,17].

The dynamic complexity in health systems means that it is not sufficient to look only at the effects of an intervention in an area or 'building block' in which the intervention was introduced. Health systems are said to be open with interlinking components which are intricately intertwined so that it is often difficult to separate the components and attribute separate effects to these. More importantly, these dynamic interactions of components of a health system occur in a specific context that cannot be ignored when reporting the effects. In fact the context also interacts with the intervention in such a way as to modify, facilitate or hinder the implementation of the intervention [8,15,18,19].

While there is still a common reductionist view that a particular intervention can be assessed using a single outcome, clearly the response to any given intervention, whether intended or not, is system-wide [8,15,18,19]. It has been acknowledged that managers and policy makers could benefit from understanding the importance of systems thinking and the complex behaviour of systems. So it is crucial to view systems as whole rather than a sum of individual components and consider the effect over time rather than relying on static or snapshot evidence [19,20]. Complexity in systems arises when the short and long term consequences of a given decision results in totally different outcomes and the effect of intervening in one component result in unexpected

consequences in another component. In practice, it is often observed that well intended actions could result in disturbingly negative consequences which are often counter intuitive [20,21].

Evidence from other sectors has produced compelling arguments for adopting systems thinking in addressing health system challenges[21]. Systems thinking allows for a proactive approach through planning and anticipation of possible systems reaction to a given intervention. Thinking ahead and anticipating both positive and negative consequences avoids short term fixes that may have negative long term consequences[22].

One major aim of health care research is to produce reliable and valid evidence to inform policy and practice. Methods that have been used to obtain it have been a matter of serious debate in recent time. It is still a common view in the field of public health that RCT are the most valid way to produce compelling evidence in research. This thinking has been recently challenged given that the nature of health systems and associated complexity cannot be controlled in many instances. For example, RCTs are conducted in a given context and other unforeseen circumstances can impact on RCT [23]. Health systems research needs to capture these complexities and so need to go beyond RCT to employ a range of system-wide and multi-method approaches [24]. Thus, both quantitative and qualitative methodologies are important in understanding health systems complexities that include the behaviour of actors which are often interlinked through positive and negative feedback loops [9,25].

The BHOMA intervention is part of the African health initiative[26]. The intervention commenced in April 2011 when the first set of health facilities received the intervention. All the health facilities are expected to receive the intervention by mid 2013.The final evaluation of the BHOMA intervention will be 2014.

The BHOMA intervention is made up of three primary strategies designed to work at different levels of the health system. These are district, health facility and community strategies.

The evaluation reported in this paper was conducted after the intervention had been in place 3-12 months. The aim was to determine whether the BHOMA intervention had changed service quality and service demand using system wide approach. The assumption was that the BHOMA intervention would lead to improvement in service quality and this will lead to increased service demand from the community. The evaluation of the BHOMA was multi-method, both qualitative and quantitative methods were employed. In this paper we report the qualitative findings applying system wide approaches to provide a comprehensive evaluation [15,18]. The analysis was guided by a systems thinking conceptual framework which was developed to provide a visual map of the intervention. We report both intended and unintended consequences and how the context affected the results of the intervention. The quantitative results are reported in another paper.

Methods:

BHOMA study design:

The BHOMA intervention is a cluster randomised trial which is being implemented in three rural districts in Zambia. These are Chongwe, Kafue and Luangwa. The study has a stepped wedge design where the intervention is being rolled-out in a stepwise fashion until all the target health facilities receive the intervention. The full methodology of the BHOMA trial is described elsewhere [27,28].

This follow-up qualitative study followed a baseline qualitative survey which was conducted in 2011 to describe the health systems and its health system building blocks and identify gaps in service delivery. The findings of the baseline study were used to inform the intervention. Full results of the baseline study are described elsewhere[29].The follow-up qualitative study was conducted 12 months after the implementation of the intervention. We conducted in-depth face-to-face interviews with key informants and focus groups discussions with community members who lived in catchment areas where the BHOMA intervention had been in place for at least 3 months. The study was conducted between May and September 2012.

Target Groups

The focus group discussions (FGDs) were conducted with men and women aged 18 years and above who had lived in the area for at least 6 months continuously. In-depth interviews at health facility level were targeted at health facility managers and community representatives who were part of the Neighbourhood Health Committee. We targeted the committee Chairperson or representative. At district level we conducted interviews with the clinical care specialists who were the main focal persons for the BHOMA intervention. We also conducted interviews with the implementation team and clinical supporters trained by the intervention team.

Sampling and sample size

A total of three districts and nine health facilities were included in the study. Three health facilities were selected in each district. The sampling for eligible health facilities was purposive. The selection criteria were that in each district, one health facility had no intervention, one had the intervention for 6 months and one had the intervention for 12 months. At each facility, the health centre in-charge, Chairperson of the Neighbourhood health committee (NHC) were interviewed. For health facilities where the intervention had been in place for 12 months. Two FGDs were held with men and women separately. In total 21 In-depth interviews and 6 FGDs were conducted. In addition, we observed the process of implementation in some health facilities to complement the data collected through interview as part of the triangulation. We observed how the patients are screened and treated. We observed the screening area which was mainly staffed by the BHOMA clinic supporters. We also observed some consultations and collections of medicines.

Selection FGD participants

Community groups were selected with the help of the NHC chairperson or community representative. Attention was paid to ensuring FGD participants had heterogeneous characteristics, i.e. different occupations, social networks, educational status. Men and women were interviewed separately.

All FGDs were held away from the health facility to avoid influence from the health workers. All interviews were recorded digitally and later transcribed by trained research assistants familiar with qualitative methods. The transcribed material was validated by the lead author.

Data collection process:

We used three different interview guides to collect qualitative data, each targeting different respondents. One in-depth interview guide targeted health workers and another targeted community representatives. One focus group discussions guide was used to collect information from community members. The data collection tools were pre-tested in the pilot sites within the BHOMA intervention. All focus group discussions were conducted in local language spoken in study sites. In-depth interviews were conducted in English except those for community representatives which were done in local language.

Data analysis

Data was transcribed by 2 trained research assistants who had experience with qualitative methods. The transcripts were validated by the main researcher. Transcripts were cleaned and exported to Nvivo 10 for analysis. The coding process followed conventional qualitative methods where the initial step was identification of common themes. These formed the basis for broader themes which were further subcategorised to increase the explanation ability of the data. The coding and analysis was done by the lead author.

Systems thinking guided analysis framework.

We used the systems thinking conceptual framework which we developed in consultation with the district and health facility managers before the implementation of the intervention to guide the analysis focusing on intended and unintended consequences of the intervention. Our framework was inspired by a recent report by WHO[16].We also looked at linkages between the different health systems building blocks and how these interact with service demand and the context. The full description of the conceptual framework and the assumptions is reported elsewhere.

In summary the major assumptions were that the BHOMA intervention will lead to improvements in the quality of service and this in turn will lead to increased service demand. Important feedback mechanisms predicted both positive and negative as shown in figure 1.

Ethical consideration

The study was approved by the University of Zambia Biomedical Ethics Committee and London School of Hygiene and Tropical Medicine. All participants were informed about the study and signed a consent form before being enrolled in the study. Confidentiality was maintained throughout data collection, analysis and publication.

Results:

The study findings are organised in two parts as follows:

Part 1 presents the descriptive findings of the study highlighting views of different stakeholders on what they observed was the effect of the BHOMA. These are generally summarised under health system building blocks in relation to service delivery though there are general overlaps between building blocks. The results report both intended and unintended consequences of the intervention.

Part 2 uses a system thinking conceptual framework to critically analyse the findings specifically looking at how the feedback loops predicted in the visual map model actually worked out based on the findings. The model included the contextual factors some of which were outside the intervention. We then discuss the broader contextual factors that were important and how these could have affected the intervention

Part 1: System wide effects of BHOMA:

Intervention learning and adaptation

Central to the BHOMA intervention was quality improvement in health service delivery through mentorship of health workers and provision of basic supplies at health facility level. The quality improvement (QI) teams provided training and mentorship as planned. However, a lot of learning and adaption were needed. This was predicted in the model as the QI teams and health workers were learning during the course of the intervention and hence adapting the way the training was done.

A clinical care specialist reported:

"The people employed by BHOMA [QI team]
come to mentor the staff at the health facility.
where a mistake is made they are readily
available to correct such mistake".
Clinical care specialist

The inertia to learn by health workers

When the intervention was initially introduced, most health workers felt that the QI team was there to take over their work and hence started leaving the work to mentors instead of sitting with them to be mentored. This was later corrected as the health workers expectations were clarified and the health workers resumed full responsibility for patient care with support by the IQ team:.

"In the initial trainings we did experience episodes of
health workers leaving work for QI teams.
We then intensified our involvement of
DHO senior staff for trainings
and supervisory visits, we have seen
a big improvement since"
QI team member

Adaptation of the training time

The training took longer than expected and hence the training time was extended. In addition, there was need for closer supervision than initially planned. This affected the initial training roll-out plans to accommodate the longer training and intensified supervision.

Health worker mentoring, training and effect on service delivery:

The QI were on the ground providing mentorship, training and supervision. This led to increased quality of care as reported by most community members and health workers. The fact that extra lay health workers were available meant that clinicians could spend a little more time on consultations. Clinical observations showed improvements in adult care[30]. In most places where BHOMA was implemented, communities were aware of the existence of the project regardless of the implementation period. Generally the community seemed to have positively responded to the intervention leading to more demand for services with more people than usual coming to get services. The communities were particularly happy with the possibility of being screened early and have an opportunity to have the blood pressure, weight and height checked. The clinical supporters trained by the BHOMA were responsible for registration and screening of patients before they were seen by trained health workers. In most places this worked very well and patients were happy to get their files quickly and their vital signs checked. The records were readily available in most of the centres as reflected in the following quote:

"Actually, since BHOMA came in, it has made a difference very much so, where our patients in the community are so much happy because OPD is now undertaken at the triage desk doing the temperature, BP, even testing for malaria"
NHC chairman, Kafue

The role of community health workers in the BHOMA intervention

The BHOMA intervention recruited community health workers who were collecting local information and helped in following up of patients. Traditional birth attendants (TBAs) were supporting women to deliver at local health facilities and helped to screen pregnant women at local health facilities:

"Community health workers are going in the fields collecting information on different issues like pit latrines, refuse pits even on communicable diseases which are in the community.
HC in-charge, Luangwa

Improvements in patient triaging system for the very sick

The introduction of the BHOMA intervention in health facilities was said to have improved the triaging systems which saw very sick patients being fast tracked and receiving early attention from health workers. This was done through BHOMA employed clinic supporters who worked at the triage desks taking vital signs and identifying those in need of urgent attention.

"The clinic supporters see when they are doing temperatures, if they notice that one has a high temperature; they go to inform the nurse or clinical officer inside to say they should attend to that patient much faster"
Female, FDG participant, Luangwa

Changes in patients records through new filing system

The BHOMA intervention introduced new patient files that were kept at the health facilities. In many places this improved the filling system and made files collection process easy for patients. Patients were no longer required to keep their files at home. This reduced the loss of patient information and improved confidentiality especially for HIV positive patients who now had similar files to all other clients.

"What I can say is that it is good, like you have HIV/AIDS, when you are in the queue to collect the medicine the files look the same"
FDG participant, Luangwa

Comprehensive patient consultations including HIV screening

The BHOMA intervention introduced use of standardised form that forced all health workers to check all the required information including examinations and offering HIV testing. This was very comprehensive when compared to baseline and sites where BHOMA was not being implemented. All clients were checked for vital signs that included temperature, weight and height regardless of the presenting problem:

"We have seen a lot of improvements...
unlike what used to happen sometime
when you go you find patients are seen but
vital signs are not done...
those things now have changed"
Clinical care specialist

Effect of the BHOMA intervention: health worker perspective

Most health workers interviewed were happy about the BHOMA intervention at their health centres. They felt they had less work load due to the help they received from clinic supporters. This appeared to have positively affected their motivation. However, the use of protocols further meant that consultations were longer than usual. With increased demand observed, the overall waiting time only changed for screening but consultation time even got longer. The following were some views from trained health workers:

"That is one of the positive things that we have noticed....
with the clinic supporters that have been employed by the
BHOMA project, they are helping to reduce
the workload for health workers"
Clinical care specialist

Improvements in Health information capture and use

The clinic supporters were also very helpful in data collection and entry leading to improvement in data quality in relation to the BHOMA. Health information collection and use was greatly improved. This was linked to decision making especially on patient management and self-evaluation and mentorship. The immediate feedback in real time meant that health facility managers could reflect on the information and immediately take remedial measures. However in some places there were challenges of integrating old systems with new systems:

"BHOMA has trained clinic supporters
who are helping in entering some of the
information on a computer such that if you need any
information today, you can walk to any health
facility where BHOMA is, you ask for information
it is just a matter of pressing a button
and you get that information"
Clinical care specialist

The effect of BHOMA on governance and community participation

Improvement in governance was noted but the culture of low community participation persisted. The government structure of NHC was largely dependent on who was on the committee and were not usually active. This was more so in peri-urban settings where it proved even difficult to hold interviews with NHCs. This is what one health facility manager said:

"Holding meetings with NHCs is a challenge.
We do not hold meetings it is real
a challenge to plan well"
In-charge, Luangwa

Effect of the BHOMA intervention on medical supply

The drugs and medical supplies were not affected by the presence of BHOMA to a large extent. Most of the improvements noted could be attributed to government initiatives and some partners who were targeting improvements in this domain. In Chongwe and Kafue, a pilot project sponsored by USAID was improving supply chain management. In Luangwa, rural drugs were available to all health facilities as this district is considered rural. Therefore improvement in supply chain management and availability of essential supplies was related to contextual factors external to the BHOMA project, however there were excellent synergies with the BHOMA intervention which improved quality of care at the health facility.

Effect of the BHOMA intervention on the finance domain

Financial management remained the same in the control and intervention sites. There was still low access to finance management training and record keeping still remained very poor. Most health workers recommended that MoH introduces finance training. The BHOMA intervention did not provide structured training in this aspect. The introduction of files reduced finance barriers to access as these were free unlike in the past when patients were forced to come with note books. The following quote highlighted the effect of the new files on access:

"Files have highly helped. At times you find others
don't have the book, you tell them to go and buy
the book they don't have money to
buy the book hence they decide to stay home.
But now the services are free,
the folders are free, they
just have to come,"
Male FDG participant, Chongwe

Unintended consequences of the BHOMA intervention

In addition to the positive effects that were reported, the BHOMA intervention had also some unintended consequences some of which were expected while others were not. In this section we present some highlights of selected unintended consequences and how these impacted on the intervention. It is hoped that lessons learnt will be used to adapt and strengthen the intervention. Table 1 provides a summary of both positive and negative consequences of the BHOMA intervention.

Challenge with the filing system

After the introduction of the new files by the BHOMA intervention, there were more clients wanting to get files even when they were not necessarily sick. Larger health facilities reported that filing space for the new files was lacking and in some places files were lying along the corridors while others were placed where ever space was available. This made it even more difficult to trace files than before resulting in new files being opened each time a patient visited the clinic. This was unintended. The problem was that the BHOMA project didn't include creation of filing rooms. There was also delay in procurement of filing cabinets as the funding sources experienced technical delays which were not anticipated. This is reflected in the following quote:

"There are too many files
because of paper work with the BHOMA,
We already had shortage of space at the
clinic but it has gotten worse now"
HC in-charge, Kafue

Challenges with clinic supporters' working hours

The contracts of clinic supporters allowed them not to work at night and over the weekend. This meant that services were negatively affected during those hours when the clinic supporters were not available especially during the weekend when more people seek medical attention as expressed by one health facility manager:

"It would have been better if clinic supporters
could work over the weekend to support us
Sometimes we have more patients over the weekend
but the contracts for clinic supporters
does not allow them to work at night or
during the weekend"
HC in-charge, Chongwe

The negative side of comprehensive consultations

The BHOMA form which required detailed screening of all systems meant that consultations were taking longer than before. While the time for triaging and screening improved because of the presence of clinic supporters, the waiting time for consultation with clinicians did not change significantly as the number of trained health workers did not change creating a back log of patients who had gone through screening yet still had to wait as before to see the clinicians. This problem was worse in bigger peri-urban health facilities which had a higher patient load as highlighted by one respondent:

"We finish fast with the clinic supporters [BHOMA]
side no when you are waiting to be called inside
we are delayed and where we collect drugs.
There is a long queue and this is
because there is only one person to
attend to us"
FDG participant, Luangwa

Conditions of service for clinic supporters

The BHOMA-employed clinic supporters were paid less than what government has recommended for minimum wage in the country. This was causing frustration among some clinic supporters and contributed to high attrition rates among volunteers as explained by one clinic supporter:

"We heard that even volunteers, any government volunteer,
they are eligible to be given a minimum wage,
but us at our office, we were not
considered, are we not government workers?
I don't know what to say...."
Clinic supporter, Kafue

Poor referral services and effect on service delivery

Referral services for emergency services were generally unreliable and this remained the case during the study period. Ambulance services were better in Chongwe but were still unreliable. Most clients were made to arrange their own transport resulting in delays in referrals as most people could not afford transport costs:

"We only have one ambulance which we
are sharing with the hospital also sometimes you may
require the ambulance service but you find
that it is in Lusaka. So you have to
wait until that ambulance comes back"
Clinical Care specialist

Part 2: System thinking conceptual framework analysis:

This section seeks to understand the mechanism of the BHOMA intervention and how the predicted feedback loops worked in practice (Figure 1). We looked at the interaction across the building blocks and the probable effect of the context guided by system thinking principles. We end with an adapted visual map (figure 2) that has addition elements that were not initially considered but found to be crucial in explaining the results of the intervention.

Tracking positive and negative feedback loops (Refer to figures 1 and 2)

Positive feedback loop R1: Intervention learning and adaptation

Two main positive feedback loops were described in the initial model shown in Figure 1. R1 described the interaction between health human resource and mentors from quality improvement team. This was mediated via the process of learning, intervention adaptation and modification. The study confirmed that the more the interaction between the mentors and the mentored the better the outcome was for adhering to the intervention. The initial turbulence where the health workers were leaving work to the mentors was reversed through trust and consistence. The intervention itself had undergone metamorphosis from the original for example the training time needed to be longer than planned and attrition among the heath workers and community volunteers meant that the original plans and numbers needed to be adjusted to take into account the high attrition rate especially among community volunteers. The materials for teaching were also made simpler by including pictures as most TBA were unable to read. In summary positive feedback loop (R1) remained essential as the interaction between mentors and health workers was dynamic requiring constant learning and adaptation of the intervention leading to improved mentorship and better acceptability of the intervention by health workers.

Positive feedback loop R2: Health Information, governance and decision making

The second positive feedback loop was predicted between human resource and governance and mediated through health information. The better the information the better the decisions for both clinical and management at health facilities. This would lead to better clinical care and human resource management resulting in better motivation and performance.

The evidence was that BHOMA greatly improved information capture at community and heath facility level. This information was available to clinicians in real time to check their performance and make improvements where necessary. The link with human resource management was not straight forward as most centres had only one health worker and it was not easy to attribute motivation to governance as there were other important factors from the intervention such as reduced work load which seemed to account more for motivation than improvement in governance.

Negative (re-balancing) feedback loops B1 and B2: Community service demand, service quality and workload:

Two negative loops were predicted from the framework. One (B1) concerned the interaction between community demand for services and service quality with expected negative effect of work overload if service demand exceeded capacity. The work overload also mediated the interaction between human resource and service demand as shown in balancing loop B2. The evidence of the study was that indeed service quality and demand improved tremendously following the BHOMA intervention. There were more demands on health workers as predicted, however, the presence of clinical supporters provided a buffer for the workload as most screening of clients and registry work was now done by clinic supporters[31]. This had reduced the overall workload though trained workers still need to do specialised services that could not be done by clinic supporters. This valve was not included in the initial model. (See figure 2)

Context and the BHOMA intervention:

Intervention ownership

One of the key issues that positively affected the implementation of the BHOMA intervention was the commitment and district ownership of the intervention. There was unprecedented commitment from all district managers to the BHOMA. The design of the intervention deliberately provided a position for a permanent representative on the BHOMA team. There was also traditional leadership involvement at the start of the intervention especially in rural places. This was an important connection between the BHOMA and the traditional structures.

Presence of other cooperating partners

In some places where BHOMA was being implemented, other partners were also actively participating in improving the health system. These partner activities could have confounded the BHOMA intervention. For example parallel projects which targeted drug and medical supplies in Chongwe and Kafue and the rural drug kits. These could have affected both baseline and follow-up results and could be responsible for the higher scores in this domain at baseline and the lack of difference between control and intervention sites.

New governance improved conditions of service for health workers

We noted that Zambia had a change of government while the intervention was going on. The new government suddenly improved conditions of service for health workers throughout the country including the intervention districts. This could have affected health worker motivation hence confounding the results of the BHOMA.

Larger health facilities and the BHOMA intervention

We observed that the effect of the BHOMA intervention was modified by the location and patient load. Most larger health facilities in the BHOMA had received the intervention. However, most of them still performed poorly despite the presence of the intervention. Though the intervention was meant to improve the quality of services, this was not always the case. In these bigger health facilities the reverse happened, where the filing systems became unmanageable and patients were being inconvenienced. This was attributed to high patient load, limited infrastructure and shortage of trained health workers. These pre-existing challenges were exacerbated by the intervention which led to increased demand for services yet the capacity remained essentially the same.

Other important contextual factors and the postulated effect of the BHOMA intervention are summarised in Table 1.

Discussion:

In this study we applied an innovative approach to evaluate a complex intervention[32]. Currently there is scarcity of evidence on application of system thinking to evaluate complex intervention in low income settings[18]. To our knowledge this is the first study to provide empirical evidence on the use of systems thinking demonstrating how it could be applied to health system strengthening intervention[16]. This represents a substantive contribution to an otherwise largely theoretical literature.

Through rigorous planning and consultation, a framework was developed before the intervention was implemented. This provided a visual map for the proposed effect to guide learning as required when applying systems thinking concepts[16]. Systems required exploration of both positive and negative effect of any intervention and thus provided information not only on the intended consequences but also unintended of the BHOMA intervention. In addition, we have provided data on important contextual factors that facilitated the successful implementation and those which could confound or hinder integration and acceptability of the intervention.

We acknowledge that our findings are still preliminary as the study is still ongoing and the final evaluation will be due in two years time. Nonetheless, our findings are crucial in demonstrating the processes that could explain the success or failure of the intervention. More importantly the results illustrates the need for a reflection point mid-implementation to allow for the intervention adaptation and learning in order to maximise the intended benefits while reducing unintended consequences[14].

The study has shown that generally, the BHOMA intervention improved the quality of service at the health facility. This was confirmed both by the community members and health workers. There were also reported improvements in community follow-up of patients who missed appointments and TBA referrals to the health centres. However, when analysis is done from a systems thinking perspective, it was clear that several unintended consequences also occurred during the implementation of the BHOMA.

During the baseline study some of the major findings were, poor quality of services, poor referral services, long distance, human resources shortages, confidentiality concerns, shortage of drug and medical supplies, financial restriction to access (buying of books).These have been described in baseline paper[33].

The evaluation showed that in health facilities where BHOMA was being implemented there were major improvements in quality of services offered with almost all clients receiving comprehensive screening that included vital signs which were never done before the intervention. The district health managers confirmed that there were improvements in places where BHOMA was working compared to control sites. The waiting time showed improvements at the point of patient contact as these were staffed by the clinic supporters employed by BHOMA. However, the shortage of qualified health workers meant that patients still needed to wait to see a clinician. This was made even worse in some cases where the health workers were unfamiliar with the new screening tools introduced by BHOMA and hence took longer on consultations than before, thereby making the waiting time even longer.

There were still health facilities staffed by only one qualified health worker or male health worker[34]. This did not change much from baseline. The BHOMA intervention employed community members and did not support recruitment of the new trained health workers. The result was that where there was only one health worker, in their absence or transfer, the services were negatively affected despite the presence of the BHOMA intervention.

Clinic supporters were very helpful in routing patients through the services and performed tasks such as triaging and recording vital signs from clients. This worked very well and in many places helped to reduce the workload from health workers who could now concentrate on consultations. This was seen as major source of motivation for health workers as they felt less over worked. Nonetheless, the clinic supporters only worked during the day, Monday to Friday. This meant that nights and weekends were not supported and hence the workload still remained high especially over the weekend. Even in the presence of clinic supporters some specialised services such as vaccinations and antenatal services required the presence of qualified health worker.

Perception of possible confidentiality breaches were very high at baseline where the communities felt that health workers could easily breach confidentiality, although this was not supported by evidence.

During the follow-up study, majority of community members interviewed admitted that most fears of possible confidentiality breach by health workers were unfounded and generated from the community members. They denied having seen such cases in the community. Interestingly, introduction of files had a magic effect on both access and confidentiality. All patients now had similar files in BHOMA intervention sites. This was not the case in control sites and at baseline. Most patients were happy with the files as no one could inadvertently reveal their HIV status owing to the type of file they were carrying.

One barrier to access was the request for all clients to buy small note books for their records at the health facility. This was seen as a big hindrance to access at baseline as many clients could not afford the cost of a note book. In sites with BHOMA intervention, the new files were free and it was prestigious for a community member to own a file at the health facility. This led to increased demand for services even among those who could previously not afford to buy books. The negative side was that even those who were not sick pretended to be in order to have a personal file at the health facility. Unfortunately, the BHOMA intervention did not include infrastructure development. In many places there were no rooms to keep files and this resulted in piles of files being put anywhere. In some big centres it became even more difficult to find a file than before. The delays in funding of the project for 6 months in 2012 meant that some places run out of stationery and services became disrupted. This was more evident in larger health facilities which had higher patient load and limited capacity.

Referral services remained poor in most places despite the BHOMA intervention. Ambulances were nonexistent or very unreliable. This was a very worrying finding which was overlooked by the BHOMA design. While quality of service improved at local health facilities patients needing further referral faced the challenge to arrange their own transport. Those who needed to be referred were most serious and most likely to die.

Literature has emphasised the need to consider context when interpreting the effect of any intervention [35,36]. This is even more important when it comes to public health interventions whose boundaries are blurred and applied across a range of context that might modify the intervention [37]. In the BHOMA study several issues were noted under context. We noted three major issues that could affect our intervention results. The first was noted in drug and supplies in all the three districts. In Kafue and Chongwe, a different project supported by USAID was streamlining the supply of drugs using different approaches. The two BHOMA districts were used as pilot sites for this project. This meant that our drug availability indicators were artificially high as the concurrent project was working to improve this. In Luangwa, all the health facilities are considered rural and benefited from rural drug kits which meant that the drug availability was guaranteed[38].This could partly explain the higher scores recorded at baseline[33] and why there were no differences between intervention and control in this domain.

The study had a number of limitations. Firstly the information was obtained from health workers who could have deliberately given positive feedback about the BHOMA as this could have been as desired and a way to continue funding for the BHOMA project. Secondly, this being a qualitative study which was done in selected rural and peri-urban sites, caution must be taken in generalising the study results to other settings. Thirdly the BHOMA intervention required huge investments to implement the intervention. This raises the question of sustainability. Finally, the study was done in some places where the intervention had been in place for just six months. It is therefore important to repeat the study when the intervention had been in place longer.

Conclusion

We applied an innovative approach to evaluate a complex intervention in low income settings. We have provided empirical evidence on the application of systems thinking in the context of health system strengthening. Though the intervention had some positive outcomes by employing system-wide approaches we also noted unintended consequences. In addition, several contextual factors seemed to interact with intervention to modifying its effect. Our findings could be useful in guiding evaluation of similar complex interventions in low resource settings.

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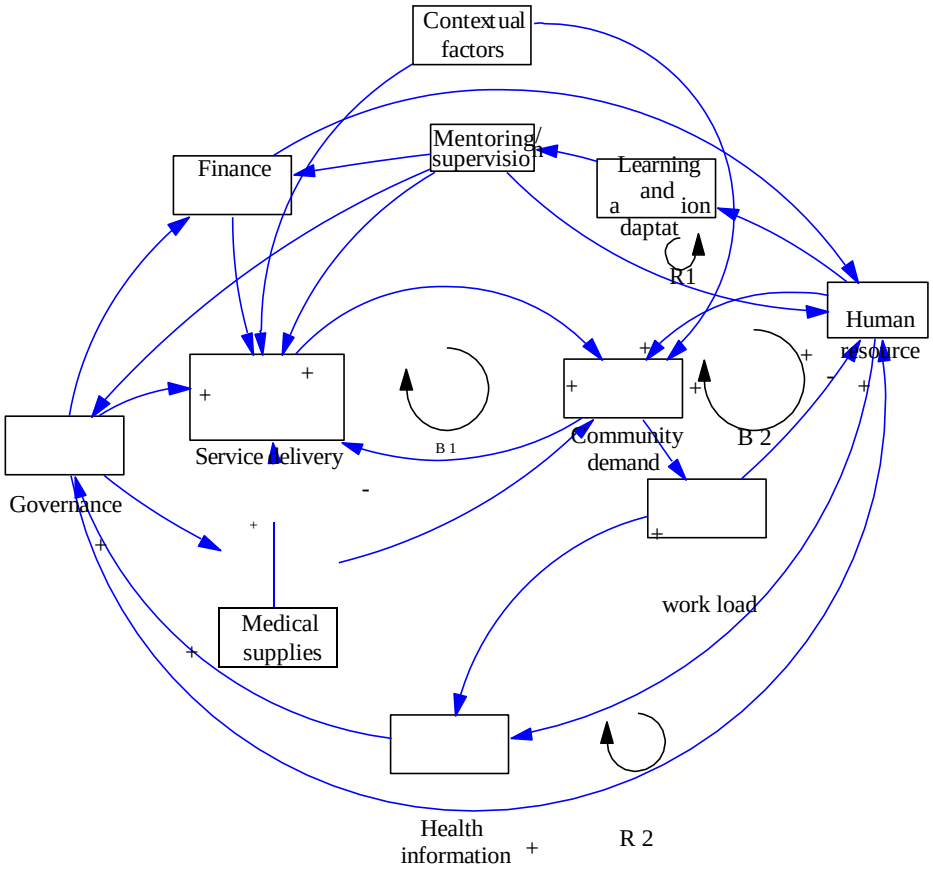

Figure 1: *Model 1 showing initial Causal loop diagram of the proposed mechanism of interaction between the health system building blocks, context and the community*

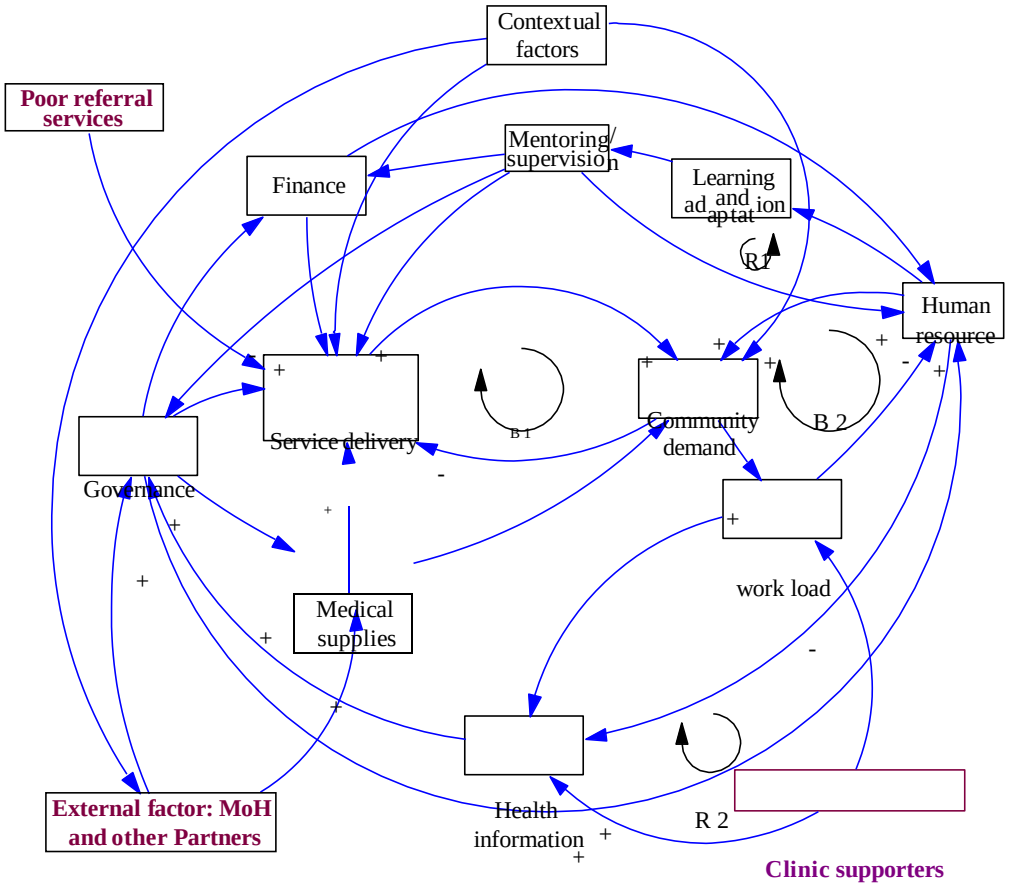

Figure 2: *Model 2 showing a modified causal loop diagram after intervention learning: additions elements are in colour*

Table 1: Summary of important contextual factors cross the three BHOMA target districts						
	Districts and health facility affected					
Contextual issues	**Chongwe**		**Kafue**		**Luangwa**	
	All facilities	*Selected facilities*	*All facilities*	*Selected facilities*	*All facilities*	*Selected facilities*
Change in the governments in Zambia between baseline and evaluation time	*Yes*		*Yes*		*Yes*	
Increased health workers salaries and conditions of service in 2011 (between baseline and evaluation time)	*Yes*		*Yes*		*Yes*	
Hospital based health facilities with better resources and staffing		*Mphanshya mission hospital*		*None*		*Katondwe mission hospital*
Rural with most long distances to health facilities		*17 rural health facilities and One health facility in the game park which was the most difficult to access*	*10 rural health facilities. Two health facilities are furthest in the game park and have no access to ambulance service*		*6 health facilities were rural though are long the main road which is gravel. One clinic was closest to the Mission hospital*	
Peri urban health facilities with largest catchment population	*3 peri urban health facilities. One was very close to Lusaka and one was the main centre*	*4 facilities were peri urban. Two had had the largest catchment populations.*				*1 peri-urban which was the largest*
District government hospital present	*Newly opened hospital*		*Has one district hospital*		*no district hospital*	
District commitment and ownership of BHOMA intervention	*Yes*		*Yes*		*Yes*	
District BHOMA team member consistence	*Same person represented the district on the BHOMA team from baseline to evaluation*		*The original member died and a new person was in place at the time of evaluation*		*Had changed the original member and a new person was in place who came from clinic with BHOMA intervention*	
Parallel intervention to improve drug and medical supply supported by USAID	*Yes*		*Yes*		*No*	
Government provided rural health kits		*Some of the rural health facilities*		*Some of rural health facilities*	*All the health facilities*	
Access to ambulance services	*Unreliable*		*Very unreliable*		*None existent*	
Strong tradition beliefs that hinder access to health services		*In most rural centres*		*In most rural centres but more so in one area*	*All the centres*	
Strong traditional leadership supporting health initiatives		*Most rural health centres. Weakest in periubarn centres*	*Most rural health centres. Weakest in periubarn centres*			*Most rural health centres. Weakest in periubarn centres*
Affected by disruption of funding to the BHOMA	*Yes*		*Yes*		*Yes*	

Table 2: Application of system thinking approach: Intended and unintended consequences				
Main sub-system	*Positive(intended)*	*Comment after intervention*	*Negative(unintended)*	*Comment after intervention*
Service Delivery:				
	-Personalised care -Improved service quality -Motivated staff **Increased utilisation, coverage of services**	**We noted improvements in personalized care and staff motivation. There was evidence of increased utilisation of services in sites with the BHOMA intervention**	-Over whelming demand for services -Overcrowding -Competition for incentives -Falsification of data to get benefit **Poor service quality**	**There was evidence of high demand for services in BHOMA sites but the service quality remained stable at least in the short term. Bigger and peri urban health facilities performed poorer compared to rural sites**
Human Resources				
	-Improved staffing levels -Improved moral and motivation among HW **-Improved quality of service-Client satisfaction with service** **-increased utilisation** **-increased coverage**	**There was no change in the number of trained health workers but there was extra man power through clinic supporters who were trained by the BHOMA. The service quality improved and utilisation**	-Competition to get incentives -Low moral if incentives are low or removed -Over whelming demand for services **Poor quality of services**	**Some volunteers who were not being paid wanted to be paid in line with clinic supports employed by BHOMA** **The service demand was stable despite the increased demand in most BHOMA sites**
Medical Supplies				
	-Availability of drugs and supplies at HF -Fewer stock outs -Good stock management practice -More community confidence **-increased utilisation and coverage**	**Availability of essential drugs was good in all the three districts.** **There were parallel programmes supporting drugs supply other than the BHOMA intervention**	-Miss use of supplies e.g drugs -Stealing of supplies -Sale to black markets -Expiry supplies -Stock out persist -Drug resistance -corruption **Poor quality of Service**	**These were not observed**
Health information				
	-More Health information infrastructure at Health facilities -Patient level data capture -Less use of stationery -Better record keeping -Community level data included -Good quality and reliable data -Easy to generate local reports **-Timely reporting** **-Evidence based-planning** **-Responsive services**	**This was noted in the BHOMA sites with improvements in quality and timely data which was used to guide decisions for patient management**	-Too much work for Health workers to enter data -Need data clerk all the time -Other services may be neglected -May suffer from interruption of power and internet services -May became corrupted -Mainly quantitative data -Data may be falsified to reach targets **-Poor quality data** **-Insufficient qualitative data**	**The new electronic medical records were not fully integrated with the MOH HMIS systems. This meant that health workers need to enter manually in the books for reporting to MOH and then using EMR for the BHOMA information**
Governance				
	-Better trained health managers -Better district planning -Evidenced based planning -Motivate district and HF workforce -Co-ordinated health Services -Better stakeholder involvement -Better retention of human resources	**There was one main person at district who was represented on the BHOMA team.** **There was evidence of using data from BHOMA sites for planning at health facility and district level**	-Loss of trained managers to urban districts. -High turnover of staff **-Poorly trained new managers** **-Bad governance practices persist**	**There was stable attrition of trained staff but there was high turnover of trained community supporters**
Finance				
	-Availability of resources -Efficient use of resources -More accountability -Reduced corruption -Better priority setting -Cost-effective intervention promoted	**There was still low level of financing training**	-More workload to account -Corruption -Other service areas may suffer -Increased miss use of available resources **Corrupt practices persist**	No corruption reported

CHAPTER 10:

10. Discussion

10.2. Summary findings

The study had three main objectives:

1. To develop indicators to mark the performance of a strengthened health system
2. To determine the effect of the BHOMA intervention on the health system in the target districts
3. To explore the important processes, contextual and system factors that could explain the observed changes

In answer to objective 1; the current study developed multiple tools and indicators for assess the performance of a strengthened health system. We developed new tools for measuring health worker motivation and health system governance. Currently there are no validated tools and indicators to measure this crucial input of health systems. The summary of indicators are shown in annex 13.2.14.
In order to assess the contribution of various building blocks of the health system we developed a balanced scorecard which captured multiple domains of a health system. We tested the domain specific indicators to assess the baseline status of the target districts and also used these same indicators to determine the effect of the BHOMA intervention in the control and interventions sites after 12 months of implementation. Generally the study found that the tools and indicators were applicable in the Zambian health care settings. Nonetheless, it was important to pilot and adapt the tools and indicators to fit the rural health facilities. We noted specific challenges with different tools. These are reported in research papers 2-5

Paper 2 specifically focused on validating the measures of health worker motivation. This is a critical building block for HSS and recently there have been calls to shift focus from the concentration of health workers and look at other attributes like motivation and governance[163,164].In this paper, we adopted and adapted the

tool by Mbindyo et al,2009. They applied this tool in hospital settings in Kenya but did not evaluate it at lower level of health care. We therefore extended this work and applied the tool and questions at health facility level in rural districts of Zambia. We noted a tendency for health workers to give higher scores which was a form of response bias. This generally affected the scores as shown by higher mean scores reported by most health facilities. The baseline results showed important differences in motivation at baseline. We observed higher scores among females and nurses. Attending in-service training seemed to have positive effect on motivation. Other studies have reported similar pattern of higher motivation among female health workers in low income settings[165]. The health worker tool and indicators are summarized in annex 13.1.4

Paper 3 was an attempt to measure governance which is one of the most important but complex health system building block[166]. Governance is said to be important in improving public health[166,167].However, it is one of the most difficult building blocks to measure and few indicators exist[166]. Most attempt to measure governance have focused at global or national level[166,168]. In this research paper we validated the questions which were initially used by the health system 20/20[99,169].

The tool was fairly reliable with a cronbach's alpha of 0.739. There was a tendency for health workers to give themselves high scores on the scale as was observed in the health worker motivation tool. The mean scores were generally higher. When the tool was applied we noted that the overall measure of governance seemed to obscure the domain specific differences that make up governance. We therefore concluded that in addition to measuring overall governance, it is important to perform sub group analysis to isolate the elements of governance. The governance tool and indicators are shown in annex 13.1.5

Research paper 4 applied a balanced scorecard approach, which is a system wide approach, which WHO has recently recommended for measuring health system performance[166].This allowed for collecting information across the six building blocks for health system strengthening. Despite the multitude of indicators these were reduced to fewer manageable indicators per domain that formed the BSC. This approach could be used in other low income settings and could be useful in

monitoring and evaluating complex health systems [166].The BSC domains and indicators are shown in annex 13.1.1-13.1.8.

In answer to specific objective 2; the study showed that BHOMA intervention had improved some domains of the health system while others were not affected**.** We were able to see this differential impact because we applied a system wide approach in the form of BSC. These findings therefore support calls for paradigm shift in evalaution of such complex interventions in low income settings [37,66,138,170,171,172,173,174,175];

The major effects of the BHOMA intervention were noted in adult clinical observation, training and health information domains. These domains showed statistically significant differences between intervention and control site and demonstrated a tendency towards dose dependence. Health worker motivation and governance domains did not show any difference between intervention and control sites. The short follow-up time might explain the lack of differences. This will require further follow-up to determine the long term impact on these domains. We are also aware that we used fairly novel tools to measure these domains. It is therefore crucial to monitor these domains overtime and triangulate the findings with qualitative information including observations. Further, we noted that the adult clinical observation domain was a sensitive marker of the effect of the BHOMA intervention. Even after controlling for other confounders it remained statistically significant. This must be followed up to see whether this remains the case and whether other health system strengthening interventions could use this domain to bench mark the performance of their interventions. These results are presented in research paper 6.

In answer to specific objective 3: The study showed that there were close linkages and relationships between various health system building blocks warranting the use of system-wide approaches. The theoretical framework based on system thinking allowed us to report both intended and unintended consequences of the intervention and the crucial role of context .This approach provided an opportunity to learn from the intervention and adapt the intervention to maximise its potential in line with principles of systems thinking.

The evaluations showed that while the original study was designed as a randomised trial this did not prevent inherent health systems factors from affecting the intervention. We noted that several contextual factors acted to hinder or support the intervention. For example we noted that despite randomization all bigger health facilities received the intervention in the first or second step. We further noted that despite being in the intervention longer most of the bigger and peri-urban health facilities performed poorly in most domains there by lowering the mean scores of the intervention. In our analysis we applied an “intention to treat” analysis to adhere to acceptable RCT reporting but it was obvious that the bigger the health facility negatively affected the scores. It is possible that the effect of the intervention could even be stronger if it were not for these poorly performing intervention sites. The intervention however seemed to work well in rural and smaller health facilities.

There have been concerns about the adequacy of RCT for evaluating such complex interventions. The concerns are that RCT fail to capture the dynamic relationships and usually do not include process data which would be useful in linking input to outcomes[176]. The preferred design for such complex intervention are plausibility designs which used multiple methods to collect information and have less political barriers though they too require a counter facial to improve validity. Our study utilised a stepped wedge design which like a plausibility designs allowed stepwise enrolled hence the ability to compare early late later adopters in addition to having a counter factual. We also strengthened our study further using a theoretical framework and a collecting process and context information which helped to link the input to the outcomes observed in terms of systems srengthening[177]

In addition to others, two important drivers of the intervention were the new filing system and the clinic supporters employed by the BHOMA study. The files appeared to reduce the cost and stigma in the community thereby encouraging community members to come to health facilities. The clinic supporters appeared to have reduced the workload for health workers. They were the first contact for clients and were said to be very efficient. However, patients still complained of delays to see the clinicians because they still remained few and the project did not recruit new trained health workers.

The intervention was also noted to have unintended consequences. It was reported in some places that members of the community were coming to attend the clinic to get files even when they were not sick. This created unnecessary congestion at health facilities and wastage of resources. In addition, increased file volumes were not matched with storage space and infrastructure thereby causing files to be poorly stored leading to difficulties in tracing files.

Using a system wide approach, we found that although the BHOMA intervention had improved performance at health facility level the poor referral systems meant that very sick patients could not afford to go to the next level of care. This finding reinforces the need to evaluate complex systems comprehensively[138]. The overall aim of the BHOMA is to reduce mortality. This will not be possible if those likely to die fail to be saved through poor referral system. We have therefore recommended that the intervention find other partners who should support referral systems in the BHOMA target districts.

10.3. Thesis contribution to the body of knowledge

This thesis has contributed the following to the body of scientific knowledge:

1. Generation and validation of measures for health system interventions. We adopted and adapted the measures of health worker motivation in low income settings. It is the first study to validate this tool at health facility level. We also adapted and validated the measures of health system governance. Currently there are no validated tools to measure governance at health facility level.

2. The study is the first to apply balanced scorecard (BSC) to measure the performance of health system intervention in a trial setting. This allowed system wide assessment of the building blocks and hence responding to the current need for evidence in this area[66,138]

3. The thesis is the first to use system thinking to measure the performance of health systems as recommended by WHO building blocks[176].

10.4. Study strengths

1. The study was designed as a clustered randomised trial which is considered the gold standard for isolating cause and effect in the field of science[178].
2. The study was evaluating a complex health system intervention. We therefore combined both qualitative and quantitative measures thereby increasing the validity of the findings through the triangulation process[177,179].
3. The study was guided by a theoretical framework. This allowed for process evaluation and developing of broad learning map for the intervention design as required when using system thinking approaches[177]. (Theory of change)
4. The study used system wide approaches that included balanced scorecard and system thinking hence providing a more comprehensive evaluation,
5. The study provided contextual information which is often not reported in trials[177]
6. The study reported both intended and unintended consequences of the intervention[171].

10.5. Study Limitations

1. The randomised trial could not be blinded so the data collectors were aware of which health facilities had received the intervention. It is possible that data collection in the intervention sites was more vigorous compared to the control sites.
2. Most of the responses were dependent on interviews or observations. These have inherent biases. For interview data, respondents could give desired responses which do not reflect the truth on the ground. Observation data could be affected in the sense that those being observed could act differently when under observation. We triangulated data sources to validate some of the responses.
3. The study was collecting data from health workers who were employed by the ministry of the health. Therefore, responses could be affected as managers would like to give a good impression of their health facility to avoid victimisation. We made efforts to assure the health workers of confidentiality during data collection and publication
4. The evaluation data is based on health facility survey and qualitative data from the community. We cannot therefore give quantitative evidence of the

effect of the intervention in the community. Community surveys were still underway at the time of this evaluation. We obtained information from key informants and exit interviews with some community members to get the community perspectives though this does not eliminate the need for community surveys.

5. The study results are based on short term observation of the intervention. The observation time ranged between 3 and 12 months. There is need to allow the intervention to be in place for a longer period of time to capture the full effect of the intervention
6. This study tries to evaluate a complex intervention of a health system[180,181]. The methodological challenges are well recognized and this study is no exception. We used mixed methods to mitigate some of the known methodological challenges.
7. The study was done mainly in rural districts of Zambia where health system challenges might be different from urban settings. Therefore our findings could be more applicable to similar rural settings and may not be generalised to urban settings.
8. The study sites were fixed and limited to 42 health facilities based on what was available in the selected districts. This resulted in small sample size especially when performing stratified analysis by districts. This was worse in Luangwa district which had 7 health facilities.

10.5.1. Validity of the BHOMA evaluation results

The BHOMA intervention used a cluster randomised controlled trial to assess the effect of the BHOMA intervention on various building blocks of the health system. This is the most rigorous and gold standard for scientific enquiry study method[178].As the study was conducted in real life and deemed beneficial we could not justify leaving out some facilities. We therefore adopted a step wedged design where the intervention being rolled out until all the health facilities receive the intervention[178]. This design was therefore suitable for answering the main questions paused in this study. Nonetheless, in order to explain the process and some contextual factors that were not reflected in the quantitative enquiry, we applied theory based approaches to guide the qualitative evaluation. This enabled

the enquiry to provide more process information about the mechanism of the intervention leading to the outcomes observed[177].

10.5.2. Reliability of the data collection

In terms of reliability most of the tools and indicators used to evaluate the health system building blocks have been used in low income settings. These were adapted from Measure evaluation and Health facility assessment network[162]. The new tools were first validated in the Zambian settings and were pre-tested before being used in the field. The baseline survey also provided addition validation. The health worker motivation and governance tools were found to be fairly reliable with the cronbach's of >0.7 which is considered an acceptable value for reliability tests[182].

The research assistants used in the data collection were trained on how to administer the tools. The main researcher personally supervised the data collection process and conducted qualitative interviews. He has worked in the Zambian health system and understood the context where the data was being collected and how the services were organized.

10.5.3. Generalisability of the study findings

The study was done in rural districts of Zambia which had specific challenges when compared to urban districts. We therefore feel that the findings are more applicable to low income settings especially rural health facilities. The results are also based on preliminary results that need further follow-up. Hence we advise cautious interpretation and generalisability of the study findings.

CHAPTER 11:

11. Concluding remarks and recommendations

11.2. Study implication and future research direction

Though WHO has provided a framework for measuring health systems strengthening, there is lack of indicators and tools to measure the contribution of some of the building blocks. For example Health worker motivation and governance are important inputs to health systems yet their contribution is often difficult to assess[90,183]. Tools to measure these attributes are urgently needed at time when most countries are lagging behind in achieving millennium development targets and donors are demanding results for their investments in health [9,15,184]. In this work, we developed and validated measures of health worker motivation and governance at health facility level. Though this is still preliminary we feel the tools could be useful to both researchers and policy makers:

For researchers:

The tools were tested in rural settings and for a shorter period of time. Further research is required to show how these tools would work in others settings and how the tools could be applied at different levels of health care. This will provide information about the generalisability of the tools. There is also need to generate evidence on how the response biases which were noted for both tools could be reduced hence increasing the validity and reliability of the tools.

Policy makers:

In the absence of alternatives policy makers and health system managers could use the tools to monitor and evaluate health systems interventions especially in rural health facilities in which these tools were used and applied. The tools were found to be easy to apply and required fairly short to time to administer, which is an important consideration for busy health facilities in resource limited settings.

Though WHO has been advocating for using system wide approaches in evaluating complex interventions, currently there is lack of empirical evidence on application of these approaches in low income settings. Most discussions have

remained theoretical and framework level. The few evaluations available have tended to be too narrow for the complexity they claim to measure [66,138].In this work two separate but complementary approaches were used to measure the effect of a complex health intervention. The balanced scorecard helped to reduce the multiple indicators and domains into few manageable scores based on the common vision. The system thinking framework helped to learn from the intervention making it possible to identify intended and unintended consequences. This has implication for researchers and policy makers:

Researchers:

How applicable and acceptable is the balanced scorecard in other settings and how easy is it to use outside experimental conditions?

How valid and reliable are the indicators used in the Balanced scorecard in other settings?

Questions still remain unanswered on how useful the balanced scorecard is in measuring long term investment in health. Our study was limited to 12 months.

More empirical evidence on application of systems thinking and other approaches in health care in low and mid income settings is required.

Systems thinking advocates for learning and adjustment of the intervention in order to maximize its effect and reduce unintended consequences. This is in contrast to ideals for conducting clinical trials which discourages tempering with the intervention. Therefore scientific dialogue is required to find middle ground for this debate.

Finally, more examples of comprehensive evaluation of complex interventions from other low income countries are required for others to learn from.

Policy makers:

The balanced scorecard used domains that WHO has recommended for health system strengthening monitoring and evaluation[40].Managers and policy makers can use the domains and indicators to benchmark their performance in the different domains as they invest in health system interventions. This will help to see the linkages between the different health systems building blocks and identify which building block provides “herd immunity” for others. The practical example of using systems thinking provided in this study can be applied to design and evaluate other similar complex health interventions. These system-wide approaches provide an

opportunity to learn and adjust the intervention rather than waiting until the end of intervention to learn about its unintended consequences.

11.3. Next steps for the BHOMA intervention

In the short term, findings from this study have been presented to the implementation and evaluating teams of the BHOMA intervention. These results are being used to understand the mechanism of the intervention and how the intervention could be strengthened through promoting the positive effect while reducing unintended negative consequences of the intervention. We have recommended that each year the both the implementation and evaluation teams should reflect on the findings of yearly surveys and adapt the BHOMA intervention in line with principles of system thinking. In this thesis, we have specifically asked the teams to explore whey bigger peri-urban health facilities performed poorly despite the intervention and make improvements accordingly.

For the evaluation team, we have recommended that a thorough and updated database for contextual factors be put in place to enable the team to understand the external factors that could affect the BHOMA intervention.

The results are expected to be presented to the health system symposium as a parallel session in 2014 in South Africa. This is in line with the call for evidence on evaluating complex systems and this study has preliminary lessons to share.

The results in this thesis are based on observation time which ranged between 3 and 12 months. The final evaluation is expected in 2014.It is hoped that the final evaluation will help to validate these preliminary findings and contribute to generation reliable information on health system strengthening in low income settings.

CHAPTER 12:

12. References:

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CHAPTER 13:

13. Appendices

13.2. Study tools

13.2.1. Health facility audit: Template for calculating domain specific scores

INDICATOR		
Basic Infrastructure		
		1 0.5 0
		0 0.5 1

		Yes	1
12.	**The facility has a toilet (latrine) that is available for clients to use**	No Yes	0 1
13.	**Condition of the toilet/latrine**	Not Functioning Functioning	0 1

Service availability		**No**	**Yes**	
14.	Immunisation services for children and child health	0	1	
15.	Family planning	0	1	
16.	Antenatal care	0	1	
17.	Any normal delivery services	0	1	
18.	PMTCT services (HIV test and ARV)	0	1	
19.	Treatment for STIS	0	1	
20.	Treatment or client follow up for TB	0	1	
21.	Voluntary counselling and testing (client walk-in)	0	1	
22.	Palliative treatment services (OI or pain) for AIDS	0	1	
23.	ART treatment or client follow up.	0	1	

Service guidelines		**Observed**	**Reported but not seen**	**Not available**
24.	Immunisation services for children and child health	1	0.5	0
25.	Family planning	1	0.5	0
26.	Antenatal care	1	0.5	0
27.	Any normal delivery services	1	0.5	0
28.	PMTCT services (HIV test and ARV)	1	0.5	0
29.	Treatment for STIS	1	0.5	0
30.	Treatment or client follow up for TB	1	0.5	0
31.	Voluntary counselling and testing (client walk-in)	1	0.5	0
32.	Palliative treatment services (OI or pain) for AIDS	1	0.5	0
33.	ART treatment or client follow up.	1	0.5	0

Register with minimum information		**Observed**	**Reported but not seen**	**Not available**
34.	Immunisation services for children and child health	1	0.5	0
35.	Family planning	1	0.5	0
36.	Antenatal care	1	0.5	0
37.	Any normal delivery services	1	0.5	0
38.	PMTCT services (HIV test and ARV)	1	0.5	0
39.	Treatment for STIS	1	0.5	0
40.	Treatment or client follow up for TB	1	0.5	0
41.	Voluntary counselling and testing (client walk-in)	1	0.5	0
42.	Palliative treatment services (OI or pain) for AIDS	1	0.5	0
43.	ART treatment or client follow up.	1	0.5	0

Register last updated		**Within last 7 days**	**<7 days ago**
44.	Immunisation services for children and child health	1	0
45.	Family planning	1	0

46.	Antenatal care	1	0
47.	Any normal delivery services	1	0
48.	PMTCT services (HIV test and ARV)	1	0
49.	Treatment for STIS	1	0
50.	Treatment or client follow up for TB	1	0
51.	Voluntary counselling and testing (client walk-in)	1	0
52.	Palliative treatment services (OI or pain) for AIDS	1	0
53.	ART treatment or client follow up.	1	0

Staff trained in last 12 months		**No**	**Yes**
54.	Immunisation services for children and child health	0	1
55.	Family planning	0	1
56.	Antenatal care	0	1
57.	Any normal delivery services	0	1
58.	PMTCT services (HIV test and ARV)	0	1
59.	Treatment for STIS	0	1
60.	Treatment or client follow up for TB	0	1
61.	Voluntary counselling and testing (client walk-in)	0	1
62.	Palliative treatment services (OI or pain) for AIDS	0	1
63.	ART treatment or client follow up.	0	1

Basic Equipment				
Equipment Availability		**Observed and functioning**	**Observed but not functioning**	**Not available**
64.	Autoclave	1	0.5	0
65.	Adult weighing scale	1	0.5	0
66.	Infant weighing scale (gradations at minimum 100 gm)	1	0.5	0
67.	Thermometer	1	0.5	0
68.	Stethoscope	1	0.5	0
69.	Blood Pressure Cuff	1	0.5	0
70.	Suction Tube	1	0.5	0
71.	Suction machine	1	0.5	0
72.	Mask/Ambu bag	1	0.5	0
73.	Timer/Watch	1	0.5	0
Laboratory capacity		**Test can be conducted onsite today**	**Observed system for test outside, receive results back**	**Test not available**
74.	Full Blood Count	1	0.5	0
75.	Anaemia (Haemoglobin, Haematocrit or litmus paper	1	0.5	0
76.	Malaria (rapid test or microscopy)	1	0.5	0
77.	Urine glucose (dispstix or benedicts test)	1	0.5	0
78.	Urine protein(disptix or acetic acid)	1	0.5	0
79.	HIV (rapid, ELISA or western Blott)	1	0.5	0
80.	AFB for TB	1	0.5	0
81.	Syphilis (VDRL or RPR)	1	0.5	0

PHARMACEUTICAL (Trace drugs)		**Present with at least one unit with valid date of expiration**	**No valid unit present**
82.	Amoxicillin suspension for children	1	0
83.	Amoxicillin tablets or capsules	1	0
84.	First-line antimalarial drugs(Coaterm)	1	0
85.	Co-trimoxazole for prophylaxis	1	0

86.	Oral or injectable contraceptives	1	0
87.	Any anti hypertensive drugs(Frusemide,propranolo)	1	0
88.	ARVS FOR PMTCT For example, AZT or NVP	1	0
89.	Country first-line ART for HIV	1	0
90.	Country first-line TB drug (Fixed dose or individuals)	1	0
91.	Insulin	1	0
92.	Paracetamol	1	0
93.	Oral rehydration salts (ORS)	1	0
94.	Vitamin A capsules (any dose)	1	0
95.	Folic acid (may be combined with iron)	1	0
96.	Iron tables (may be combined with folic acid)	1	0
97.	Salbutamol	1	0
98.	Food supplements for children	1	0
99.	Food supplement for adults	1	0
100.	Utero tonic(e.g.Oxtocin)	1	0
101.	DPT 3 vaccine	1	0
102.	Tetanus toxoid vaccine	1	0

Infection Control		**No**	**Yes**
103.	Chlorine-based disinfectant	0	1
104.	Latex gloves (clean or sterile)	0	1
105.	Sharps container	0	1
106.	5 ml plastic syringe in sterile packet	0	1
107.	19- or 21-gauge needle in sterile packet (may be with syringe)	0	1
108.	Hand-washing soap (bar or liquid)	0	1

Disposal of hazardous waste materials			
109.	**Do you have an INCINERATOR**	No Yes	0 1
110.	**How do you dispose INFECTED WASTE**	BURNING AND BURYING BURNING ONLY NOTHING DONE	1 0.5 0
111.	**How do you dispose INFECTED SHARPS**	BURNING AND BURYING BURNING ONLY NOTHING DONE	1 0.5 0
112.	**Any obvious medical waste in the surroundings**	No Yes	0 1

13.2.2. Adult Clinical Observation Questionnaire

BACKGROUND INFORMATION

Instructions: This questionnaire is to be administered to health workers who are seeing the patients at the time of the Facility Study

HF_ID	*Health Facility ID*	
HF_NAM	**Health Facility Name**	
NAi	**Name of Interviewer**	

		D D M M Y Y Y Y
HF_AO _01	*Date of Visit*	

HF_AO _02	*Observation*		Of
HF_AO _03	*Cadre*		

		Male	Female
HF_AO_04	*Sex*	1	2
HF_AE_05	**Age in years**		

HF_AO_06	**Department/Section**	Outpatient	1
		ART Clinic	2
		VCT	3
		Antenatal (MCH)	4
		TB Clinic	5
		Other	6
		Specify	

HF_AO_07_1	**Time began**	:
HF_AO _07_2	**Time ended**	:
HF_AO _07_3	**Total visit time**	

HF_AO _08	**Language of session**	Nyanga	1
		Bemba	2
		English	3
		Other	4
		Specify	

HF_AO _09	**Main complaint (Check all that apply)**	Cough	1

Fever	2
Headache	3
Abdominal pain	4
ARV Treatment	5
Antenatal	6
Voluntary Testing and Counselling	7
Other	8
Specify	

HF_AO_10 **Type of visit (Check that apply)**

Initial visit (new problem or new referred	1
Follow up visit (Previously diagnosed problem)	2
Other	3
Specify	

WELCOME AND RAPPORT WITH PATIENT/CLIENT

HF_AO_11 **Did the health worker?**

		No	Yes	N/A
HF_AO_11_1	Receive patient in welcoming manner	0	1	9
HF_AO_11_2	Introduce self to patient	0	1	9
HF_AO_11_3	Offer patient a seat	0	1	9
HF_AO_11_4	Explain presence of observer	0	1	9
HF_AO_11_5	Obtain consent from the patient for the observer to be there	0	1	9

HISTORY TAKING

			No	Yes	N/A
HF_AO_12		**Did the health worker ask about?**			
	HF_AO_12_1	Ask about the presenting problem	0	1	9
	HF_AO_12_2	Ask about past medical history	0	1	9
	HF_AO_12_3	Ask about HIV status	0	1	9
	HF_AO_12_4	Identify danger signs (Respiratory, convulsions, severe pain, fever >39°C)	0	1	9

		No	Yes
HF_AO_13	**Was physical examination done (If NO, go to** HF_AO_15_1)	0	1

			No	Yes	N/A
HF_AO_14		**If YES, Did the health worker**			
	HF_AO_14_1	Explain rationale and procedure for physical examination	0	1	9
	HF_AO_14_2	Ensure patient has privacy	0	1	9
	HF_AO_14_3	Prepare the instruments before exam	0	1	9
	HF_AO_14_4	Wash hands before exam	0	1	9
	HF_AO_14_5	Perform a general examination	0	1	9
	HF_AO_14_6	Perform obstetric examinations	0	1	9
	HF_AO_14_7	Thank the patient after examination	0	1	9
	HF_AO_14_8	Order appropriate investigation	0	1	9

DIAGNOSIS

HF_AO_15 **Diagnosis (Health Worker's diagnosis)**

		No	Yes	N/A
HF_AO_15_1	HIV			
HF_AO_15_2	Tuberculosis	0	1	9
HF_AO_15_3	Malaria	0	1	9
HF_AO_15_4	Pregnancy related	0	1	9
HF_AO_15_5	Hypertension	0	1	9
HF_AO_15_6	Diabetes	0	1	9
HF_AO_15_7	Other	0	1	9
HF_AO_15_8	**Specify**			

HF_AO_16 **Observer's diagnosis**

		No	Yes	N/A
HF_AO_16_1	HIV			
HF_AO_16_2	Tuberculosis	0	1	9
HF_AO_16_3	Malaria	0	1	9
HF_AO_16_4	Pregnancy related	0	1	9
HF_AO_16_5	Hypertension	0	1	9
HF_AO_16_6	Diabetes	0	1	9
HF_AO_16_7	Other	0	1	9
HF_AO_16_8	Specify			

MANAGEMENT

HF_AO_17		No	Yes
HF_AO_17_1	Observer agrees with health worker	0	1
HF_AO_17_2	Observer diagrees with health worker	0	1
HF_AO_17_3	Observer not sure of management plan	0	1
HF_AO_17_4	Health worker not sure of management plan	0	1

HF_AO_18	**Did observer prompt health worker to reconsider treatment?**	No	Yes	N/A
		0	1	9

HF_AO_19	**Did the health worker explain the treatment to the patient?**	No	Yes	N/A
		0	1	9

HF_AO_20	**Did the health worker give the next appointment for the patient?**	No	Yes	N/A
		0	1	9

HF_AO_21	**Did the health worker allow the patient/client to ask questions?**	No	Yes	N/A
		0	1	9

THANK THE RESPONDENT FOR THEIR PARTICIPATION

	Interviewer's code	Date								Signature
		d	d	m	m	y	y	y	y	

Interviewer										
Field Manager										
1st data entry										
2nd data entry										

13.2.3. Children Clinical Observation questionnaire

HF_ID	**1**	**Health Facility ID**	
HF_NAM		**Health Facility Name**	
NAI		**Name of Interviewer**	
HF_CO_01	**2**	**Date of Visit**	D D M M Y Y Y Y
	3		
HF_CO_02_1	**4**	**Starting time**	:
HF_CO_02_2	**5**	**Ending time**	:
HF_CO_02_3		**Total Time**	

READ CONSENT FORM TO HEALTH WORKER, READ CONSENT FORM TO THE CHOSEN CARETAKER/PATIENT BEFORE THEY ENTER THE CONSULTATION ROOM. OBSERVE FIVE CONSECUTIVE ELIGIBLE CLINICAL CASES, ELIGIBLE CASES ARE THOSE THAT ARE SICK CHILDREN, 1-59 MONTHS OF AGE. THEY SHOULD BE SEEN FOR ANY ONE (OR A COMBINATION) OF THE THREE FOLLOWING REASONS: CHILDREN: MALARIA OR FEVER, ARI OR RAPID OR DIFFICULT BREATHING, DIARRHOEA
ADULTS: HIV/TB/HYPERTENSION
THERE IS A SEPARATE COLUMN FOR EACH OF THE FIVE CASES OBSERVED.
FOR EACH QUESTION, TICK YES, NO, OR NOT APPLICABLE

HF_CO_03	**Case Number**	
HF_CO_04	**Age of child (in completed months 1-59)**	

HF_CO_05 **Reason for visit (Circle ALL that apply) Should only be for fever/malaria, cough/rapid or difficult breathing, and/or diarrhoea**

HF_CO_05_1	Coughing/breathing problem	1
HF_CO_05_2	Fever/malaria	2
HF_CO_05_3	Diarrhoea	3

HF_CO_06 **Does the Health worker:**

		No		Yes
HF_CO_06_1	Ask about the ability to feed or breastfeed	0		1
HF_CO_06_2	Ask whether the child vomits everything	0		1
HF_CO_06_3	Ask about the presence of convulsions	0		1

HF_CO_07 **Does the health worker:**

		No	Yes		NC
HF_CO_07_1	Check nutritional status on child health card	0	1		2
HF_CO_07_2	Check vaccinations on child health card	0	1		2

HF_CO_08 **Does the health worker classify the child as having :**

		No	Yes	RDT	N/A
HF_CO_08_1	Fever of malaria	0	1	3	9
HF_CO_08_2	Pneumonia or fast/difficult breathing	0	1		9
HF_CO_08_3	Diarrhoea without blood	0	1		9
HF_CO_08_4	Diarrhoea with blood	0	1		9

HF_CO_09 **Does the health worker prescribe:**

		No	Yes		N/A
HF_CO_09_1	First line anti malarial	0	1		9
HF_CO_09_2	First line antibiotic for pneumonia	0	1		9
HF_CO_09_3	ORS	0	1		9
HF_CO_09_4	First line antibiotic for diarrhoea with blood	0	1		9
HF_CO_09_5	Other antibiotic	0	1		9

HF_CO_10 **Does the health worker explain how to administer:**

		No	Yes		N/A
HF_CO_10_1	First line anti malarial?	0	1		9
HF_CO_10_2	First line antibiotic for pneumonia?	0	1		9
HF_CO_10_3	ORS?	0	1		9
HF_CO_10_4	First line antibiotic for diarrhoea with blood	0	1		9

HF_CO_11 **Does the health worker advise:**

		No		Yes
	About need to continue feeding during illness?	0		1

Supervisor Recode for Indicator #11 (HW performance - treatment): Does classification (HF_CO_09) match the medication prescibed (HF_CO_10)?

		CASE		
HF_CO_12_1	Malaria or fever / first line antimalarial	Match	Not match	RDT
HF_CO_12_2	Pneumonia or difficult breathing / first line antibiotic for pneumonia	Match	Not match	
HF_CO_12_3	Diarrhoea **without** blood / ORS but no antibiotic	Match	Not match	
HF_CO_12_4	Diarrhoea **with** blood / first line antibiotic for dysentery	Match	Not match	
HF_CO_13	**INDICATOR #11 (numerator = all match)**	All match	Not all match	RDT done

HF_CO_14 NOTE ANY QUALITATIVE OBSERVATIONS HERE:

THANK THE RESPONDENT FOR THEIR PARTICIPATION

	Interviewer's code	Date								Signature
		d	d	m	m	y	y	y	y	
Interviewer										
Field Manager										
1st data entry										
2nd data entry										

13.2.4. Health worker questionnaire with Motivation scale

BACKGROUND INFORMATION

HF_ID	**6**	**Health Facility Code**	
HF_NAM	**Health Facility Name**		
NAI	**Name of Interviewer**		
HF_HW_01	**7** **8**	**Date of Visit**	D D M M Y Y Y Y

INSTRUCTIONS: Administer this questionnaire to Health Workers found at the Health Facility

Demographic Characteristics

HF_HW_02 **Age in years**

HF_HW_03 **9** **Sex**

Male	female
1	2

HF_HW_04 **Cadre**

Nurse	1
Clinical Officer	2
EHT	3
Doctor	4
CDE	5
Other	6
Specify	

HF_HW_05 **Time in the post**

Upto 3 months ago	1
4-6 months ago	2
7-12 months ago	3
More than 12 months ago	4

HF_HW_06 During the last 12 months, have you received any training **IF NO SKIP TO HF_HW_08**

No	Yes
0	1

Questions on motivation:
Do you strongly agree, agree, somewhat agree, disagree or strongly disagree with each of the following statements

		Strongly agree	Agree	Some what agree	Disagree	Strongly disagree
HF_HW_10	**General Motivation**					
	These days, I feel					
HF_HW_10_1	motivated to work as hard as I can	5	4	3	2	1
HF_HW_10_2	I only do this job so that I get paid at the end of the month	5	4	3	2	1
HF_HW_10_3	I do this job as it provides long term security for me	5	4	3	2	1
HF_HW_11	**Burnout**					
HF_HW_11_1	I feel emotionally drained at the end of the every day	5	4	3	2	1
HF_HW_11_2	Sometimes when I get up in the morning, I dread having to face another day at work	5	4	3	2	1
HF_HW_12	**Job satisfaction**					
HF_HW_12_1	Overall, I am very satisfied with my job	5	4	3	2	1
HF_HW_12_2	I am not satified with my colleagues in my work	5	4	3	2	1
HF_HW_12_3	I am satisfied with my supervisor	5	4	3	2	1
HF_HW_13	**Intrinsic job satisfaction**					
HF_HW_13_1	I am satisfied with the opportunity to use my abilities in this job	5	4	3	2	1
HF_HW_13_2	I am satisfied that I accomplish something worthwhile in this job	5	4	3	2	1
HF_HW_13_3	I do not think that my work in this health facility is valuable these days	5	4	3	2	1
HF_HW_14	**Organisational commitment**					
HF_HW_14_1	I am proud to be working for this health facility	5	4	3	2	1

HF_HW_14_2	I find that my values and this health facility are very similar	5	4	3	2	1
HF_HW_14_3	I am glad that I work for this facility rather than other facilities in the country	5	4	3	2	1
HF_HW_14_4	I feel very little commitment to this health facility	5	4	3	2	1
HF_HW_14_5	This health facility really inspires me to do my very best on the job.	5	4	3	2	1

Conscientiousness

HF_HW_15_1	I cannot be relied on by my colleagues at work	5	4	3	2	1
HF_HW_15_2	I always complete my tasks efficiently and correctly	5	4	3	2	1
HF_HW_15_3	I am a hard worker	5	4	3	2	1
HF_HW_15_4	Do things that need doing without being asked or told	5	4	3	2	1

Timelines and attendance

HF_HW_16_1	I am punctual about coming to work	5	4	3	2	1
HF_HW_16_2	I am often absent form work	5	4	3	2	1
HF_HW_16_3	It is not a problem if I sometimes come late for work	5	4	3	2	1

THANK THE RESPONDENT FOR THEIR PARTICIPATION

	Interviewer's code	Date								Signature
		d	d	m	m	y	y	y	y	
Interviewer										
Field Manager										
1st data entry										
2nd data entry										

13.2.5. Health facility Governance questionnaire

TO BE ADMINISTERED TO HEALTH FACILITY

HF_ID	**10**	**Health Facility ID**	
HF_NAM		**Health Facility Name**	
NAI		**Name of Interviewer**	
Q01_DAT	**11**	**Date of Visit**	D D M M Y Y Y Y

Statements of Good Health Governacne Practice
Indtructionhs: PLEASE FILL IN THIS SELF ASSESSMENT FORM. SAY WHETHER YOU AGREE OR DISAGREE WITH THE FOLLOWING STATEMENTS IN RELATION TO WHAT HAPPENS AT THIS HEALTH FACILITY

4=Agree 3=Some what agree 2=Some what disagree 1=Disagree

Vision

Q02_1_PRO	The health facility has protocols for adult, child and maternal health services from the MoH	4	3	2	1
Q02_2_LOI	Local organisations and health service users have influence on what services are offered at the health facility	4	3	2	1
Q02_3_FMP	The facility managers ensure that Health workers follow protocols, standards and codes of conduct	4	3	2	1
Q02_4_RRE	The health facilities receive regular external quality check team to ensure that the protocols and standards are followed	4	3	2	1

Q02_5_VIS Vision score (out of 16)

Intelligience and oversight

Q03_1_CAD	The health facility collects and analyses local data	4	3	2	1
Q03_2_RRD	Health facility managers rely on research data from health facility to plan services	4	3	2	1

Q03_3_IIS	The health facility use evidence on program results, patient satisfaction, and other health-related information to improve the services they deliver	4	3	2	1

Q03_4_INS	**Intelligience score (out of 12)**		

Regulation and management capacity (fair rules of the game)

Q04_1_MCC	There is a mechanism for correcting those not complying with standards and code of conduct	4	3	2	1
Q04_2_IPD	Health services are organised and financed in ways that offer incentives to health workers and community health workers to improve performance in the delivery of health services	4	3	2	1
Q04_3_PPP	There are forums and procedures that give the public, technical experts, and local communities' opportunities to provide inputs into the development of priorities, strategies, plans, and budgets	4	3	2	1
Q04_4_AUR	The allocation and utilization of resources are regularly tracked and information on results is available for review by the local communities and concerned stakeholders.	4	3	2	1
Q04_5_SER	Systems exist for reporting, investigating, and adjudicating misallocation or misuse of resources.	4	3	2	1
Q04_6_OFS	The health facility regularly organize forums to solicit input from the public and concerned stakeholders (vulnerable groups, groups with particular health issues, etc.) about priorities, services, and resources.	4	3	2	1
Q04_7_CSQ	The public or concerned stakeholders have regular opportunities to meet with managers of the health facility to raise issues about service efficiency or quality	4	3	2	1
Q04_8_PPB	The public and concerned stakeholders have the capacity to advocate and participate effectively with the health facility officials in the establishment of policies, plans, and budgets for health services.	4	3	2	1
Q04_9_QCG	Information about the quality and cost of health services is publicly available to help clients make choices as to where they want to go for health services	4	3	2	1
Q04_10_INE	There are procedures and systems that clients, providers, and concerned stakeholders can use to fight bias and inequity in accessing health service	4	3	2	1

Q04_11_RES	**Regulation Score:(out of 40)**		

Q04_12_TGS **Total Governance Score (out of 68)** | | |

THANK THE RESPONDENT FOR THEIR PARTICIPATION

	Interviewer's code	Date								Signature
		d	d	m	m	y	y	y	y	
Interviewer										
Field Manager										
1st data entry										
2nd data entry										

13.2.6. Adult exit interview questionnaire

HF_ID		**Health Facility ID**	
HF_NAM		**Health Facility Name**	
HF_DIS	**12**	**District**	
NAI	**13**	Name of Interviewer	
			D D M M Y Y Y Y
HF_AE_01	**14**	**Date of Visit**	
	15		
HF_AE_02	**16**	**Department**	
	17		
HF_AE_03	**18**	**GPS Coordinates** Latitude	S - ° , ‘
	19	Longitude	E 0 ° , ‘
	20		
HF_AE_04	**21**	**Starting time**	:
HF_AE_04_1	**22**	**Ending time**	:

		Male	Female
HF_AE_05	**23 If female, ask “What is your pregnancy status?”(Important for ANC/PMTCT) IF NO GO TO HF_AE_07**	1	2
	HF_AE_05_1	Pregnant	Non pregnant
	24	1	2
HF_AE_06	**Age in years**		

HF_AE_07 **Educational Level**

None	0
Primary	1
Secondary	2
Tertiary	3

HF_AE_08 **Marital Status**

25	Single	1	26	Married	2
Widowed		3	Divorced/separated		4

HF_AE_09 **How did you get here?**

27	On foot	1	28	Bus/Taxi	2
Bicycle		3	Carried/Wheelbarrow		4

HF_AE_10 **How long did it take you to get here**

Less than one hour	1
1-3 hours	2
More than 3 hours	3
Not sure	4

VISIT, GO TO HF_AE_15

First Visit	1
More than once a week	2
About once a week	3
About once a month	4
Less than once a month	5

HF_AE_12 **When were you last here?**

Earlier this week	1
Last week	2
Last month	3
More than a month ago	4

HF_AE_13 **About how long were you here last time**

Less than 1 hour	1
1-2 hours	2

2-3 hours	3
More than 3 hours	4

HF_AE_14 **How much will this visit cost?**

Less than K5000	1
K5000-K10000	2
K10000-K30000	3
More than K30000	4
Nothing	5
Don't know	**9**

HF_AE_15 **What services did you come for today** *(Circle appropriate)*

Antenatal	1
Antiretroviral Treatment (ART)	2
Voluntary Counselling and Testing (VCT)	3
Tuberculosis Treatment	4
Malaria	5
Other	6
Specify	

HF_AE_16 **What visit is this for you with this problem (If client came for ANC, please indicate)**

29	Initial visit	1
30	Follow up visit	2
Other		3

HF_AE_17 **Where you given any medication today? (IF NO, GO TO HF_AE_17_3)**

No	Yes
0	1

HF_AE_17_1 **If yes, Did the health worker explain how you are to take your medication?**

No	Yes
0	1

HF_AE_17_2 **Did the health worker tell you the side effects of the medicine?**

No	Yes
0	1

No	Yes

HF_AE_17_3	**Did the health worker tell you when you should come for the next appointment?**	0	1

		No	Yes
HF_AE_18	**Are you happy with the services you received today?**	0	1

		No	Yes
HF_AE_18_1	**Would you recommend a friend to come to this health facility if they had a similar problem like you?**	0	1

HF_AE_18_2	**If no, give reasons?** **31**	

How would you rate the service(s) you received from this health care facility? (Ask the client about each item individually)

		Poor	Unsatisfactory	Satisfactory	Good	Excellent
HF_AE_19_1	Waiting time	1	2	3	4	5
HF_AE_19_2	Privacy/space for consultation	1	2	3	4	5
HF_AE_19_3	Information/education materials	1	2	3	4	5
HF_AE_19_4	Interaction with HW	1	2	3	4	5

HF_AE_20	**Explain any items ranked "Unsatisfactory" or "Poor"**	

HF_AE_21	**What do you think can be done to improve the services at this health care facility?**	

For pregnant women only (see question 1)

No	Yes

HF_AE_22	**Have you ever been tested for HIV during this pregnancy?**	0	1

		No	Yes
HF_AE_22_1	**If never tested, did the health worker offer you an HIV test today?**	0	1

		No	Yes
HF_AE_22_2	**Did the health worker talk to you about HIV in pregnancy today (PMTCT)**	0	1

		No	Yes
HF_AE_23	**Have you made plans about your delivery?**	0	1

	Tick more than one	Money for transport	1
		Other transport arrangements	2
		Decided on place of birth	3
		Person to assist at delivery	4
		Baby clothes	5
		Other	6

	birth?	At my home	1
		At my parents'home	2
		At the nearest health facility	3
		nearest	4
		At the nearest hospital	5
		Other	6

HF_AE_25	**Why do you want to deliver at the above place?**	It is the nearest	1
		I trust the place	2
		I don't trust my nearest health facility	3
		local clinic	4
		I do't have a choice	5
		Other	6

THANK THE RESPONDENT FOR THEIR PARTICIPATION

	Interviewer's code	Date								Signature
		d	d	m	m	y	y	y	y	
Interviewer										
Field Manager										
1st data entry										
2nd data entry										

13.2.7. Children exit interview questionnaire

HF ID	**Health Facility ID**	
HF_NAM	**Health Facility Name**	
NAI	**Name of Interviewer**	
HF_DIS	**District**	

D D M M Y Y Y Y

HF_CE_01 **13. Date of Visit**

CASE number

Age in years

HF_AE_05

For each of the following questions, I would like you to tell me if you thought the service was very good, good, fair or poor

		Poor	Fair	Good	Very good
HF_CE_02_1	**14. The time you had to wait to be seen: Was this very good, good, fair or poor?**	1	2	3	4
HF_CE_02_2	**15. The explanation you received of your child's illness: Was this very good, good, fair or poor?**	1	2	3	4
HF_CE_02_3	**16. The treatment you received for your child's illness: Was it very good, good, fair or poor?**	1	2	3	4

HF_CE_03 **Did the health worker give you any medicines? If YES, continue. If NO, end interview** No (0) Yes (1)

Can you please show me the medicines given to you by the health worker?

HF_CE_04_1 **Medicine 1**

HF_CE_04_2 Amount Mg/Mls/Tablets

HF_CE_04_3 Number of times per day

HF_CE_04_4 Number of days

Can you please show me the medicines given to you by the health worker?

Medicine 2

Amount

Number of times per day | | | |

Number of days | | | |

Can you please show me the medicines given to you by the health worker?

Medicine 3 | |

Amount | | | |

Number of times per day | | | |

Number of days | | | |

Thank you for participating. We will use this information to help improve health services in this area

Supervisor Recode for Indicator #12 (HW performance - counseling)			**CASE**	
HF_CE_05_1	Is the caretaker's description of medication, dose, frequency and duration correct (Q.202)?	MED1	Correct	Not Corr.
HF_CE_05_2		MED2	Correct	Not Corr.
HF_CE_05_3		MED3	Correct	Not Corr.
HF_CE_06	**Indicator #12 (numerator = all correct)**		All correct	Not all correct

13.2.8. Finance questionnaire

HF_ID	**13.**	**Health Facility ID**	
HF_NAM	**14.**	**Health Facility Name**	
HF_DIS		**District**	
NAI		**Name of Interviewer**	

HF_FN_01	**15.**	**Date of Visit**	D D M M Y Y Y Y

HF_FN_02	**16.**	**GPS Coordinates**	Latitude	S	-			°			’			‘	
	17.		Longitude	E	0			°			’			‘	

Instructions: Enter the amount of money in the boxes provided. If no records are available indicate “No record”. If not sure indicate “Not Sure”. If not applicable write “N/A”

HF_FN_03 **Do you have an action plan for the last 12 months?**

No	0
Yes, copy seen	1
seen	2

HF_FN_04 **Do you have a person who is full time or parttime in charge of financing section at this health facility?**

No	0
Yes	1

HF_FN_04_1 **If yes, has this person received any training in Finance Management in the last 12 months? (If NO or NOT SURE, go to HF_FN_05_1)**

No	0
Yes	1
Not sure	9

HF_FN_05 **Indicate how much was received from the amount you budgeted in the last 12 months?**

Budgeted								
Received								

HF_FN_06 **The last disbursement you received, how long did it take for you to receive the money from time of requesting?**

HF_FN_07 **Do you charge patients for any user fees?**

No	0
Yes	1
Not sure	9

HF_FN_25 **Did you receive any form of donation/payment in kind?**

No	Yes
0	1

D_FN_26_1 If yes to HF_FN_25, can you list down all the items received in the last 12 months and their quantities?

Item & Qty	Donor	Amount (ZMK) where possible							

THANK THE RESPONDENT FOR THEIR PARTICIPATION

	Interviewer's code	Date								Signature
		d	d	m	m	y	y	y	y	
Interviewer										
Field Manager										
1st data entry										
2nd data entry										

13.2.9. Focus group guide for qualitative study

COMMUNITY FOCUS GROUP (Men and Women separately)

Time: 1 hour

Objectives: To explore the relationship between the community and Government facilities in relation to WHO six building blocks for health systems strengthening

Materials

- Flip chart
- Tape recorder
- Markers
- Sticky stuff
- Facilitator note book
- Pens
- Information sheets
- Consent forms
- Spare batteries
- Digital Camera

Preparations

- Suitable Venue within the community
- All materials laid out and ready for use
- Drinks and snacks for the participants and facilitator
- One facilitator should record the following details for each participant: **Name, age, sex, marital status, source of income, number of children and length of stay in area**

Introduction

(Self introduction by facilitator and LFW)

ZAMBART, CIDRZ AND CMMB are working together on a project aimed at improving the patient-provider interaction within Government health facilities which are important in improving health outcomes. We have selected all of you to represent your community as we value what you can share with us about your experiences in accessing health services in this community.

1. Have you heard about the BHOMA Project in this area?(If not explain the BHOMA)
2. Have you seen any changes at the health centre or community since the BHOMA came in your area?

3. Has the waiting time changed?How has this changed?
4. Has the filing system changed? (Please explain)
5. Was buying of books affecting access to health service?How?Is this still happening or not?
6. How do you describe the behaviours and attitude of the health workers in this place? In last survey many clients complained about the behaviours of Health workers, has this changed in any way? (Why?)
7. Does the ambulance come to take patients in this area? How long does it take for an ambulance to come?
8. Do you trust health workers to keep confidentiality at this health centre? (Why?)
9. Which medical supplies run of out of stock? (Probe for RDT, Paediatrics formulation) and why?

10. Do you have any questions?

Thank you very much for your time,

13.2.10. Qualitative interview guide

KEY INFORMANT INTERVIEW GUIDE

Time: 1 hour

Community:_____

Objectives:

- To establish reasons and explanations for observed trends from baseline data analysis in relation to the six WHO building blocks for health system strengthening
- Two collect qualitative information on the perceived impact of the BHOMA intervention where it has been implemented

Introduction

ZAMBART, CIDRZ AND CMMB are working together on a project aimed at improving the patient-provider interaction within Government health facilities which are important in improving health outcomes. The project has been running for over 12 months the district.

We have selected you to so that you could share your experience with BHOMA and other health services in this district.

Service delivery:

Health facility managers and district team

1. What services are doing well and which services are not doing well in the last 12 months?
2. Do you have service guidelines for managing patients? Why is that most of the health centres do not service guidelines?
3. Why is that most services needing referral to other centres/hospital are not doing well in most health centres?
4. Do you have an ambulance that help with patient referrals? How long does it take for an ambulance to come if requested for?
5. Have you noticed any change in service delivery since CIDRZ BHOMA was implemented in this clinic/District? (Probe for what has changed? For the better or for worse, waiting time, filing, quality of service?

6. How long does it take for pregnant women to complete her ANC visit? Is this a problem? What can be done about this?
7. Is there any difference in the services given to Children, young people, adult men and women?(Probe for male and youth friendly services and barriers to gender access)
8. Do you think that the gender of the health workers can affect access to health services(Probe for which services are affected)

Health human resource:

9. Sometimes health workers are not found at the health facilities what are some of the reason for this?
10. Does this affect delivery of health services? (Probe: How? What can be done to change this?)
11. Do you think that everyone has an equal opportunity to attend in service training (short or long term courses in this district? (Probe who is likely to attend and why?)
12. What would you say about health worker motivation in this district? Are they motivated or not? Why is this so? In our last study we found out that when some health workers were asked to rate their motivation they rated themselves very highly why do think they did this?
13. Has the presence of CIDRZ BHOMA affected health worker performance? In which way?(Explain)
14. How useful are the CDEs in running of health facilities in this district? What jobs do they do? How do you acknowledge their work? Are the CDE happy to work for free? What do you think motivates them?

Medical supply

15. Which medical supplies are usually out of stock and Why?
16. How would you describe the availability Rapid Diagnostic Tests (RDT).
17. When RDTs are out of stock how do health workers treat suspected malaria cases?
18. Do you have some drugs that are usually out of stock? Why?
19. Has the presence of the CIDRZ BHOMA team improved drug supply and availability? If so,how has this changed?
20. How do you describe the laboratory capacity in this district? For the test you cant do locally how do ensure that patients needing them actually get them done?

Finance systems

21. How easy is it to access finance records when doing routine performance assessment for facility?(Probe for reasons)
22. Why is it that most health facilities have difficulties showing a copy of action plans?

23. We have noted that most people handling finances for most health facilities have not received any training. Do you think that this important or not?
24. Do you think that the buying books to use at the health facility could affect access to health services (How?).Do you think this is a problem here?

Health information

25. We have noted that most health facilities have poor recording keeping e.g HMIS, Registers. What do you think is the reason for this? What can be done to improve this?
26. Has the presence of the CIDRZ BHOMA improved health information collection and use? (How? Please Explain)
27. Is the data information from BHOMA and HMIS integrated? (Probe for reasons).What can be done to improve this?

Governance:

28. How would you describe the level of community participation in the running of health facilities in this district?
29. Do members of the community have the capacity to check that health workers are not mistreating patients or abusing their power?(How do they hold them accountable?)
30. Do you think that NHCs represent the community adequately? (Why?)

13.2.11. Information sheet for the BHOMA study

You are invited to take part in a Health facility survey which is seeking to find out the experiences of working or using your health facility. We are carrying out this survey in 42 health facilities in Chongwe, Kafue and Luangwa districts. Information on the study is supplied in this document. A trained fieldworker will be on hand to explain it and answer all your questions. Please check that you understand everything in this document. If you decide to take part, you will be asked to give written consent before you take part.

Who is doing the study?

This survey is being performed by health workers and researchers from ZAMBART Project from the University of Zambia led by Dr Helen Ayles. ZAMBART Project is based at the Ridgeway Campus in Lusaka. The full contact details are:

ZAMBART Project, P.O Box 50697, Lusaka Phone 021-1254710; Fax: 021-1257215 Email: *Info*@zambart.org.zm.

The Team leader for this survey is Dr.Wilbroad Mutale. He can be contacted on +260979322831 or email:wmutale@yahoo.com.

This research protocol has been approved by the University of Zambia Research Ethics Committee:

The Chairperson

Research Ethics Committee

University of Zambia

Ridgeway Campus

P.O Box 50110

Lusaka, Zambia

Tel/Fax 021-1250753

Email: unzarec@zamtel.zm

What is the purpose of the study?

This survey is being carried out in all health facilities which are part of the BHOMA study in Chongwe, Kafue and Luangwa districts. The BHOMA (Better Health Outcomes through mentoring and assessment) study is a study which is being done by the Centre for Infectious Disease Research (CIDRZ) group in conjunction with the Catholic Medical Mission Board (CMMB) and the Ministry of health through the district health offices to try and improve the health of communities. The study mainly involves special training and assistance for the health care workers in your local health clinic. We hope that the training and assistance that they receive will help to improve the quality of care at the health clinic and that this will result in better health for the community. In addition to the health clinic we are working with community health workers in the clinic catchment area to increase their numbers and to improve their work.

The study is being gradually rolled out to all of the health clinics in these districts. It may not yet have been rolled out to your local clinic but we need to measure health services in the health facilities with and without this new intervention. For this time, we are collecting baseline information that we will track over time as the intervention progresses.

We will ask you about your experiences of working or using the health facilities. We will ask you about the challenges you may be facing when providing or accessing health care in your community. This information will help us better understand what is happening in the provision and the use of the health services in your clinic area.

Taking part in this study is voluntary.

You are free to withdraw from this study at any stage, without any consequences for you.

No financial reward will be given to any persons taking part in this study.

Are there any risks for people who take part in this survey?

Taking part in this study does not pose any risks to you or your family. However, you may feel worried about the questions being asked and whether this will affect your job or access to health services.

However, the following will be required of those taking part:

1) You will be asked to sign a consent form after you have read and understood this information leaflet. You will be given an original copy of this leaflet and the consent form to keep.

2) You will be asked to complete (with the help of a trained interviewer) a questionnaire about your experiences

What is the benefit to you of taking part in this study?

By taking part in this study you will be helping us to try and improve health services in your area.

Quality assurance

We will check the quality of data that will be collected. You may be revisited by other members of the study team who will check and confirm that you have been visited by the field team. You may be asked to provide your signature or fingerprint again so that we can confirm that you were visited and we may ask you some questions again.

Confidentiality of information and privacy of the participant

All personal information obtained during this study will be kept strictly confidential. The answers will be written on a questionnaire, but your name will not be included, and you will be identified by a coded number only.

No information about you will be released to any one but the research team, without your further consent. The results of the study may be published in a scientific journal but your name will not be published.

Thank you for reading this information sheet. If you have any questions, please ask them now. The interviewer will be pleased to answer them. If you wish to take part, please read and sign the consent form. Please keep this information sheet in a safe place.

13.2.12. Consent form

INFORMED CONSENT FORM FOR THE BHOMA STUDY

1. I confirm that I have read the information sheet, and that the information about my taking part in this survey have been explained to me.
2. I confirm that I have had the opportunity to ask questions about the study and that I am satisfied with the answers provided.
3. I have been given time and opportunity to read the information carefully, to discuss it with others and to decide whether or not to take part in this study.
4. I understand that the researchers will keep all my personal information confidential.
5. I understand that I will not get any financial reward for taking part in this study.
6. I understand that the results of this study may be published in scientific journals but that my name will not be used.
7. I agree to take part in the survey.

Subject's signature/fingerprint: _ Date

_____

Subject's name: _ (please print)

The person who obtains the informed consent discussion must also sign and date this form.

Signature:_____Date _____

Name:_____(please print)

Signature of witness (if applicable)

Signature of witness: _____Date_____

Witnessed by (print name): _____

13.2.13. Ethical approval

13.2.13.1. University of Zambia Biomedical Research Ethics committee approval

THE UNIVERSITY OF ZAMBIA

BIOMEDICAL RESEARCH ETHICS COMMITTEE

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Ridgeway Campus
P.O. Box 50110
Lusaka, Zambia

Assurance No. FWA00000338
IRB00001131 of IORG0000774

21 December, 2010
Our Ref: 004-12-08

Dr Namwinga Chintu
Centre for Infectious Disease Research in Zambia
P.O. Box 34681
LUSAKA

Dear Dr Chintu,

RE: SUBMITTED RESEARCH PROPOSAL: **"BETTER HEALTH OUTCOMES THROUGH MENTORING AND ASSESSMENT "BHOM A" (FORMERLY KNOWN AS "CLINICAL MENTORING AND COMMUNITY ENGAGEMENT TO IMPROVE HEALTH OUTCOMES)"**

We acknowledge receipt of your letter dated 23 September, 2010 and take note of contents therein.

The suggested amendments as detailed in your letter (dated 23 September, 2010) are approved.

Yours sincerely,

Dr James Munthali
VICE CHAIRPERSON

13.2.13.2. London School of hygiene and Tropical Medicine ethics approval

LONDON SCHOOL OF HYGIENE
& TROPICAL MEDICINE

ETHICS COMMITTEE

APPROVAL FORM
Application number: **5900**

Name of Principal Investigator	**Dr Helen Ayles**
Faculty	**Infectious and Tropical Diseases**
Head of Faculty	**Professor Simon Croft**

Title: **Better Health Outcomes through Mentoring and Assessment (BHOMA)**

This application is approved by the Committee.

Chair of the Ethics Committee .....

Date .....17 March 2011.....

Approval is dependent on local ethical approval having been received.

Any subsequent changes to the application must be submitted to the Committee via an E2 amendment form.

13.2.14. Adapted Summary of indicators for the Evaluation of the BHOMA intervention

Service delivery Domain	Indicators		Data source	Questionnaire	comment
	Coverage	***Quality***			
Adult Health Services (AHS)	% Suspected TB correctly screened	% TB cure rate	HF survey	Health facility audit	Not available in all*
	% Eligible HIV Positive on ART	% Retention rate	HF survey	Health facility audit	Not available*
	% Hypertensive patients on medication	% Visited clinic HF last 12 for Check ups	HH survey	Community survey	Not available in all*
		% Service satisfaction	HF survey	Exit interviews	Collected Annex:13.1.6
Average score (AHS)					
Child Health Services (CHS)					
	% Slept under bed net last night	% Slept under treated bed net	HF survey HH survey	Community survey	Still being collection
	% Diarrhea last 2 weeks given ORS	% Diarrhea correctly treated	HF survey	Community survey and clinical observations	Still being collection
	% Suspected Pneumonia referred to HF	% Suspected pneumonia correctly treated	HF survey	Community survey and clinical observations	Still being collection
	% Infants HIV exposed screened at 6 weeks (PCR)	% HIV exposed screened at 12	HF survey	Health facility audit	Not available in all*
		% Service satisfaction	HF survey	Exit interviews	Collected: Annex 13.1.7
Average score(CHS)					
Antenatal Services (ANC)					
	% Pregnant women tested for HIV and received results	% HIV positive pregnant women who received PMTCT package	HF survey	Facility audit	Poorly recorded
	% live birth attended by skilled HW	% of women seen within one week by HW/CHW after delivery	HH survey	Community survey	Still being collection
Average score (ANC)					
Mean Score (All Services)					
Overall health system					
	% HIV controlled in the community	% patients on ART with viral suppression at 6 months?	HF survey HH survey	Community survey	Still being analysed

Human Resources:	***Indicator***		Data source	Questionnaire	
	Coverage	***Quality***			
	% Receiving Training last 12	% Receiving supervision last 12 months	HF survey	Health worker questionnaire	Collected: Annex 13.1.1
	Density of health workers per 1000 population	% Present on the actual day of survey	HF survey	Health facility audit	Collected: Annex 13.1.1
	Motivation Score (23 items)	FGD with HW on motivation	HF survey	Health worker questionnaire and FGD with HWs	Collected: Annex 13.1.4
Medical Supplies					
	Infrastructure score (11 items)	Verification by inspection	HF survey	Health facility audit	Collected: Annex 13.1.1
	Pharmaceutical Score 17 (items)	Verification by inspection	HF survey	Health facility audit	Collected: Annex 13.1.1
	Equipment /Diagnostics Score (16 items)	Verification by inspection	HF survey	Health facility audit	Collected: Annex 13.1.1
	Infection Control Score (9 items)	Verification by inspection	HF survey	Health facility audit	
Total Medical supplies Score	**Total Score out of 53**				

Governance					
Health facility level	Vision, oversight & Intelligence, regulation, community participation, accountability	Both quantitative and qualitative information	HF survey	Governance tool & Key informant interview	Collected: Annex 13.1.5 & 13.1.10
Finance	Availability of budgets, Finance training	Both quantitative and qualitative information	HF survey	Finance tool & Key informant interview	Collected Annex: 13.1.8
***Not available in all sites: The indicators were available in few health facilities hence could not be used to compare all the 42 health facilities**					